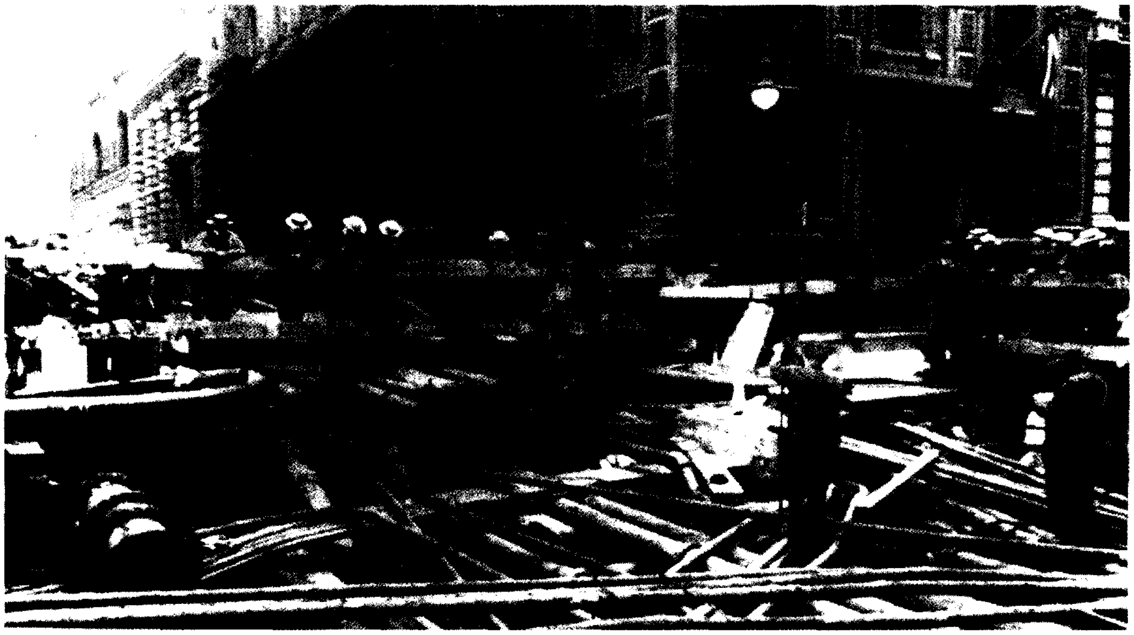
LET S.U.E. HELP YOU!



SUBMITTED FOR CPM PROJECT

BY ROBERT E. RYGGS
JANUARY 22, 2003

LET SUE HELP YOU!

According to the 2000 U.S. Census Bureau, South Carolina is the 15th fastest growing state in America, with a population of over 4 million.[1] In the last decade, South Carolina incurred a 15 percent increase in population largely due to an influx from the North.[2] With South Carolina's mild weather, lower property taxes, and generally good economy, it should continue to grow at a steady rate. Therefore, the amount of new road construction and maintenance of existing roads will also continue to expand steadily. SCDOT's 27 in 7 program is already trying to address this potential. Building better roads faster, safer and saving the taxpayers money is the goal of SCDOT. According to Elizabeth Mabry, Executive Director of SCDOT, "We continue to explore innovative ways of improving our transportation system in South Carolina. Our citizens deserve nothing less."[3] Subsurface Utility Engineering (S.U.E.) is SCDOT's solution to getting utilities involved so these roads can be built.

WHAT IS S.U.E?

Subsurface Utility Engineering (SUE) is an engineering process for accurately identifying the quality of subsurface utility information needed for highway plans, and for acquiring and managing that level of information during the development of a highway project. Although SUE is primarily a preliminary engineering activity, the real benefits come during construction. Properly used, SUE prevents unnecessary utility relocations; eliminates unexpected conflicts with underground utilities; reduces contractor delays, subsequent claims and redesign costs; and enhances safety.[4]

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[1] *27 in 7, Peak Performance,* SCDOT, 2002, 1.
[2] Jason Zacher, "South Carolina's Population Tops 4 Million," *The Greenville News,* December 28, 2000.
[3] *27 in 7,* 19.
[4] "Subsurface Utility Engineering: Enhancing Construction Activities," FHWA-IF-01-011, March 2001. http://www.fhwa.dot.gov/construction/fs01011.htm.

With significantly increased congestion on our roadways, relocation coordination, cooperation, and communication are more essential than ever. According to a three-year study by Washington-based group Smart Growth America, the Greenville-Spartanburg, SC area is the fifth most sprawling metropolitan region in the country. Four of the top six sprawling regions were on the Interstate 85 corridor from Atlanta to Raleigh-Durham, N.C.[5] The SCDOT began an accelerated program in 1999 that peeked July 2002, that is taking 27 years of planned work and compressing it into 7 years. Currently in District Three alone, there are over 65 projects scheduled for 2003. (See **Appendix A**).

A study done by Penn State University for the American Association of State Highway Transportation Officials (AASHTO) Highway Subcommittee on Construction found that utility relocation is one of the main causes of delays and added expense to road construction projects.[6] This comes as no surprise, as it is well known to highway engineers that uncoordinated utility relocation activities often cause expensive delays and disruptions. What can be done to alleviate this problem? To start, the proper use of information obtained using subsurface utility engineering (SUE) can help engineers avoid the need to relocate many utility lines. When utility relocations cannot be avoided, early and frequent coordination, cooperation, and communication (CCC) result in more timely and efficient relocation activities. (July 2002 FHWA-IF-02-048)

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[5] Bob Montgomery, "Greenville-Spartanburg ranks fifth in nation for sprawl," *The Greenville News*, October 17, 2002, 1B.

[6] "CCC: Making the Effort Works! Viewing and Discussion Guide," FHWA, March 2002, http://www.fhwa.dot.gov/programadmin/viewer.htm.

According to Paul Scott, Utilities Coordinator for the Federal Highway Administration: "It's a national disgrace, the amount of money we spend to relocate utilities that really don't need to be relocated. They could be designed around if the designers had this good Subsurface Utility Engineering information and used it."[7] He further states, "The bottom line is that we are working for the taxpayer. It might be the [utility] ratepayer. Well, the taxpayer is the ratepayer."[8]

In order to understand SUE, it is important to define the quality levels of utility information that are available to the design engineer, constructor, and project owner. The concept of quality levels was developed from the realization that sometimes more reliable information on the location of underground utilities is known to the engineer, but is not typically presented within any documents for the benefit of others. Examples of the wide range... include a gas line for which there exists a certified reference to recoverable survey control portrayed in the same manner as a water line for which there is only a verbal recollection by a water company representative.[9]

Four separate quality levels of utility information are now generally recognized by various organizations. The generally accepted definitions are as follows.

- Quality Level D (QL D): Information derived solely from existing records or verbal recollections.
- Quality Level C (QL C): Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D information.
- Quality Level B (QL B): Information obtained through the application of appropriate surface geophysical methods to identify the existence and approximate horizontal position of subsurface utilities. "Quality level B" data are reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances and reduced onto plan documents.
- Quality Level A (QL A): Information obtained by the actual exposure (or verification of previously exposed and surveyed utilities) of subsurface utilities, using (typically) minimally intrusive excavation equipment to determine their precise horizontal and vertical positions, as well as their other utility attributes.

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[7] Ibid.
[8] Ibid.
[9] "Cost Savings On Highway Projects Utilizing Subsurface Utility Engineering," *Purdue University Study*, December 1999, Report Overview.

This information is surveyed and reduced onto plan documents. Accuracy is typically set at 15mm vertical, and to applicable horizontal survey and mapping standards.

All state transportation departments (DOT's) have been introduced to SUE. Many use it routinely in the development of highway projects. Those departments that are not using it are missing out on substantial time and money savings.[10]

Subsurface Utility Engineering:
Enhancing Construction Activities

The Virginia DOT has been using SUE since 1984 and uses it on all projects. DOT's in Maryland, Delaware, Texas, Georgia, Florida, North Carolina, Arizona, and several other states are also big users. Many other states are beginning to use it. One of the advantages to using SUE is that federal-aid highway funds may be used for SUE at the normal pro rate share for the project.[11]

AGC, ASCE ENDORSE SUE

At a public meeting on January 16, 1997, the National Transportation Safety Board (NTSB) recommended the Associated General Contractors of America (AGC) "promote the use of subsurface utility engineering among its members to minimize conflicts between construction activities and underground systems." The AGC immediately indicated intent to comply with this recommendation and has done so. The American Society of Civil Engineers (ASCE) is developing a consensus standard entitled, "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data."[12] This standard received its approval in 2001.

Other organizations such as the Federal Aviation Agency (FAA), Network Reliability Council, various state DOTs, county governments, and so forth has also used this concept.

[10] FHWA-IF-01-011.
[11] Ibid.
[12] Ibid.

PURDUE UNIVERSITY GIVES SUE HIGH MARKS

The Federal Highway Administration (FHWA) commissioned Purdue University to find out how effective SUE is in reducing costs on highway projects. Researchers documented a savings of $4.62 in avoided costs for every $1.00 spent for SUE.[13] (See **Appendix B** for Purdue University Study) This is a win-win situation for both the DOT's and the utility owners. According to the Federal Highway Administration (FHWA), the use of SUE in a systematic manner should result in a minimum national savings of approximately $1 billion per year.

S.U.E. RESEARCH

The research aspect of the S.U.E. project included both a survey/ questionnaire and a follow-up meeting with high-level utility vendors. The questionnaire was sent to the full spectrum of utilities (i.e. CATV, electric, communications, gas, water, etc.) as well as SCDOT engineers. The follow-up meeting involved the same people, and was well received. The purpose of the research was twofold: (1) to get much needed input on the utility relocations, and (2) to gauge cooperation/communication from the utilities toward S.U.E.

(See Appendix C for actual survey and responses.)

The survey responses were varied, but there was some consensus among the respondents on certain subjects.

- **Lead-time**. The consensus seemed to be the need for about six to eight months of lead-time to fulfill all aspects of utility relocation. Obviously, the earlier they are given accurate final plans, the better they are able to meet their obligations.

The recent MCI/WorldCom bankruptcy has reinforced this point. MCI/WorldCom must get court approval to justify spending any monies on a road project or to obtain additional funds for a project. This situation requires additional lead-time.[14]

- **Right-of-way acquisition**. Several of the utilities expressed difficulty in obtaining right-of-way for their relocations. SCDOT by law may only acquire enough right-of- way for the roadway/bridge project. Coordinating the approach of the property owner together or sharing the research information so as to not duplicate efforts would help this matter.

  Berea Public Service District required additional right-of-way to relocate its sewer line for SCDOT Project 23.333A, US 25, Greenville County. They had to approach each property owner on the project after the SCDOT right-of-way agent approached them. Doing this takes more time, creates public ill will, and increases costs.

- **Safety**. Many of the respondents noted a concern for safety issues for their own employees, the contractors' employees, and the public. Some of these issues involved separate relocation times due to the nature of their utility, and the bulk of the work to be done in non-peak times. Some also mentioned sensitive safety issues unique to their specialized fields that are regulated and required by the federal government.

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[13] FHWA-IF-01-011.
[14] Andrew Backover, "WorldCom Files Bankruptcy," *The Greenville News,* July 22, 2002 1A.

Safety is a matter of life and death, and is in no way to be taken for granted. On November 26, 2002, three York County Natural Gas workers suffered serious burns when a flatbed truck erupted in flames after one of the men apparently tried to drive it away from an exposed and leaking gas line.[15] Sadly, there are many other examples of lapsed safety issues that had even worse results. (See Appendix D).

- **Involvement in design phases**. One of the greatest needs expressed was for early involvement and consideration of the utilities in the design phase of the project. Their inclusion and involvement is a major way to save the public money, keep them safer, and reduce inconvenience.

  By involving Williams Gas Pipeline – Transco in the design phase of SCDOT Project 23.327A, I-385, and making their recommended minor adjustments, SCDOT was able to save two million dollars. This scenario, in varying amounts, could be repeated many times.

- **Minimize or eliminate plan changes**. Almost all of the respondents expressed negative sentiments concerning plan changes and the unrealized impact of those changes on their efforts. Although they realized that sometimes change was unavoidable, if their input had been sought, those changes may have had less impact on their workload.

  On SCDOT Project 23.246A, I-85, Piedmont Natural Gas facility was relocated according to the project plans as coordinated by the Resident Construction Engineer. The plans were revised, causing the utility to relocate their facility a second time directly due to this plan change. Even

[15]Tim Eberly, "Natural Gas Blast Injures 3," *The Herald*, November 27, 2002, 1A.

though the second relocation was at SCDOT's expense, it causes time delays, and reluctance for a vendor to cooperate with SCDOT.

- **Specialization of certain utilities**. Certain utilities, due to government regulations, certifications/testing requirements, and risk involved, preferred not to contract out their part of the relocation to an SCDOT subcontractor, which would be a utility-approved contractor.

  According to Eric Thomas of Fort Hill Natural Gas Authority, Federal requirements prohibit such without proper qualifications and certifications and drug/alcohol testing of employees performing natural gas installations. He preferred to select his own utility contractor directly rather than coordinating through SCDOT.

- **Special considerations**. Sometimes due to inclement weather, services that need to stay active, and unusual circumstances, special consideration needs to be given to these utilities. The earlier the utilities are involved, the sooner these issues can be discovered and resolved.

  On December 4, 2002, an ice storm swept through the Southeastern United States impacting 1,375,000 Duke Energy customers,[16] and 100,000 Charter Communication customers.[17] This is just one example of a natural disaster that can have a disastrous effect on utility relocations.

Overall, the utility respondents expressed a cautious enthusiasm toward implementing S.U.E. The attitude at the follow-up meeting suggested a

[16] John Boyanoski, Duke: Ice Storm Cost $130 Million, but No Rate Boost," *The Greenville News,* December 18, 2002, 1A.

[17] Sarah G. Bonnette, More than a Third of Charter Customers in Upstate without Cable Service, *The Greenville News,* December 5, 2002.

willingness, and even eagerness, to begin S.U.E., as long as there was proper coordination, cooperation, and communication with all parties involved.

Coordination, Cooperation, and Communication

Coordination

The key is to involve the utilities at the initial planning and engineering design phase of the project through the completion of the construction. Accurate information included in the plans through Subsurface Utility Engineering is crucial. After this information is acquired early on, the project needs to be designed with utilities in mind.

Cooperation

The utility needs to take the information and invest time up front to accurately plan and design their facilities involved in the project. They need to plan their budget with the project in mind. Furthermore, they need to plan their work schedule in accordance with the construction of the project.

Communication

There must be up to date information in order to plan and coordinate effectively. Use the Internet to review the SCDOT Lettings, State Transportation Improvement Projects, and Accelerated Construction Projects. These companies and the SCDOT utility coordinator should make all efforts to attend the already scheduled monthly Utility Coordination Committee (UCC) meetings.

a. Anderson – Second Thursday of each month

b. Greenville – Third Wednesday of each month

c. Oconee/Pickens – Third Tuesday of each month

d. Spartanburg – Second Wednesday of each month

e. South Carolina – Second Tuesday bi-monthly

f. NC/SC Joint UCC Conference April annually

When a problem or situation arises, knowing who to contact, and then actually following up and making the contact, is a definite benefit—SCDOT State Utilities Manager, Marion Leaphart; Regional Manager, Joel Wimberly; and District 3 Utility Coordinator, Robert Ryggs. Communication must go both directions, and the SCDOT utility coordinator needs to maintain an up-to-date utility vendor contact list.

The Benefits of SUE

Subsurface utility engineering benefits both highway agencies and utilities in the following ways:

- Unexpected conflicts with utilities are eliminated. The exact location of virtually all utilities is known and accurately shown on the construction plans. This significantly:
    - Reduces delays caused by redesign when construction cannot follow the original design due to utility conflicts.
    - Reduces delays to the contractor during highway construction caused by cutting, damaging, or discovering utility lines that were not known to be there.
    - Reduces subsequent contractor claims for delays resulting from unexpected encounters with utilities.
- Unnecessary utility relocations are avoided. Accurate utility information is available to the highway designers early enough in the development of a project to design around many potential conflicts. This significantly:
    - Reduces costly relocations normally necessitated by highway construction projects.

  - Reduces delays to the project caused by waiting for utility work to be completed so highway construction can begin.
- Safety is enhanced. When excavation or grading work can be shifted away from existing utilities, there is less possibility of damage to a utility that might result in personal injury, property damage, and releases of product into the environment.[18]

Subsurface Utility Engineering is being successfully used by many agencies with great savings. We have only just begun to see the positive results of S.U.E. (See [illegible]). "President Bush asked his cabinet to help states cut through federal bureaucratic inertia to help them complete sound transportation projects more quickly and at less cost," said Secretary Mineta.[19] The implementation of S.U.E. can help fulfill the President's request. S.U.E. is an effective means of handling utility involvement in road and bridge construction projects and should become the standard at the South Carolina Department of Transportation.

[18] FHWA-IF-01-011.

[19] Bill Outlaw, "U.S. Transportation Secretary Mineta Announces List of Infrastructure Construction Projects For Accelerated Environmental Review," *U.S. Department of Transportation News*, October 31, 2002, DOT 100-02.

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SCDOT TENTATIVE LETTINGS

District Three

January 2003

www.scdot.org > Doing Business > Tentative Lettings
www.scdot.org > Inside SCDOT > Publications > STIP Report
www.scdot.org > Inside SCDOT > Accelerated Construction Program > Review Project Status

ANDERSON COUNTY
BOBBY PATTERSON, RME 864-260-2215
SEAN KNIGHT, RCE (BILL TIPPETT, ASST. RCE) 864-260-2210
GREENVILLE COUNTY
MIKE HOLDEN, RME 864-241-1224
TIM CALLENBACK, RCE 864-241-1030
TOMMY HENDRICKS, RCE (ALAN SMITH, ASST, RCE) 864-241-1025
STEPHANIE AMELL, INTERIM RCE 864-241-1024
OCONEE COUNTY
WAYLAN NICHOLSON, RME 864-647-0798
JOHN COBB, RCE (BOBBY CASSELL, ASST. RCE) 864-647-0879
PICKENS COUNTY
JOHN SANDERS, RME 864-859-0039
JOHN COBB, RCE (DON CLARK, ASST. RCE) 864-859-0034
SPARTANBURG COUNTY
FRED FLEMING, RME 864-587-4725
DENNIS GARBER, RCE 864-587-4720
DAVID HEBERT, RCE (TOMMY BLACKWOOD, ASST. RCE) 864-587-4722

CRM WEST
DAVID HINDERSON, RCM 864-770-2105
DONGEE LEE, RCM 864-770-2122
HOPE ROARK, RCM 864-770-2134
LEE ROBERTSON, RCM 864-770-2109
BILL SULT, RCM 864-770-2130
COE VINSON, RCM 864-770-2100

PROGRAM MANAGER
CHRISTY HALL (PENNY PHILLIPS, ASST) 864-241-1010
MIKE MEETZE (CLINT SCOVILLE, ASST) 803-737-1295

S=SCDOT C=CRM B=SCDOT/CRM

	File No.	RCE	Contractor	Project Description	% Compl.	Completion Date (Orig. or Rev.)
S	4.100B	Hebert	Lazer	S-57 (6 & 20 Rd) Br Ov 3 & 20 Ck	94.24	9/5/2002
S	4.101B	Hebert	Lazer	S-229 (Excelsior Rd) Br Ov 18 Mi Ck	91.04	10/31/2002
S	4.123B	Hendricks	Sloan	Dist. Resurfacing	86.00	7/31/2003
S	4.127A	Knight		US 29 @ SC 81	19.56	11/22/2002
	4.130B 37.129B	Cobb	Sloan Constr. Co	US 76 (Anderson), SC28 & US 76 (Ocor	55.17	10/30/2003
	4.132B	Knight		US 29 BS B/O C&NW RR & S-688	0.00	
C	4.158A	Robertson	Thrift Dev.	SC 24 from 0.25 mi. West of SC 28 By-Pass t	40.54	11/30/2004
C	4.163A	Knight / Sult	Sloan	SC 81 Fr Circle Dr To SC153	19.01	9/24/2003
S	4.2001	Knight		US 178 @ S-581 Reloc Rd	14.01	4/30/2003
S	4.2000.2	Knight	Thrift Dev.	US 178 @ Manse Jolly Rd	28.62	10/31/2002
C	4.842	Knight / Sult	F&R Asphalt	SC 81From Gentry Rd. Near Starr to Iva	28.65	4/30/2004
S	3023.100B	Dist 2		I-385 Resigning Fr I-26 To Gnvl City Limits		
S	23.139B 42.128I	Hebert	Hoffman Electric	Signing rehabilitation on I-85	0.00	12/15/2002
C	23.151B	Garber/ Vinson	Thrift	SC 14 Fr S-492/S-164 To SC 146	39.42	6/9/2003
S	23.161B	Amell	Sloan	I-85 @ S-492 Inter Improv	50.67	11/30/2002
S	23.162B	Amell	Sloan	I-85 @ SC 146 Add Turn Ln	50.67	11/30/2002
S	23.163B	Amell	Sloan	I-85 @ US 276 Add Turn Ln	50.67	11/30/2002
S	23.175B	Hendricks	Sloan	Resurfacing	61.00	5/31/2003
S	23.227A	Amell	APAC	I-385 @ S-55 Fairview Rd	67.80	4/29/2003
C	23.239A	Hendricks/ Roarl	Sloan	SC 183 Widening/Bridge	65.46	11/15/2003
S	23.2001	Hendricks	Sloan	Resurfacing	37.00	11/30/2002
C	23.342A	Cobb/ Sult	Eagle	US 25 widening / brigde	39.60	6/10/2002
S	23.458A	Amell	SLOAN	SC 146 Widen Fr SC 14 To SC 296	100.00	6/4/2002
S	23.474A	Callenback	APAC-Georgia	SC 14 & I-85 Inter, Bridge	71.32	7/4/2002
C	23.477A	Callenback/ Hen	Blythe	I-385 Widening	36.32	6/17/2004
C	23.479A	Cobb / Robertson	Sloan	SC 20 5 Lane Fr US 25 To So. Conn	35.02	10/31/2003
C	23.481A	Garber/ Vinson	Sloan	SC 14 Phase 1	17.25	4/30/2004
S	23.488A	Amell	WHAM	S-107 @ S-655 Turn Ln	0.00	4/30/2004
S	23 39.614	Hendricks	Modern Contin	US 123 Repl Br Ov Saluda River	73.00	2/4/2003
	23.691	Hendricks	US Group	US 276/25, SC 291& SC 253 Widen	90.00	7/4/2002
S	37.106B	Cobb	Triplett-Peek	S-66 Repl Br Ov Beaver Dam Ck	96.56	5/31/2002
C	37.780 39.730 E	Cobb/ Sult	Sloan	SC 93 Widening / Bridge	66.53	9/5/2003
S	39.2001	Cobb	Thrift Bros.	Cartee Road @ Inter. Of US 123	0.00	9/20/2003

S	39.674	Cobb	Thrift Dev	US 76/123, SC 93 Widen, BO US 76, US	92.47	2/21/2003
S	39.763	Cobb	S&S Constr	SC 135 Fr SC 8 To 2nd St	18.11	7/31/2003
S	42.103B	Hebert	Carolina Renew	SC 129 @ S-60 Intersec Improv	47.36	6/30/2002
	42.108B	Garber/ Vinson	Morgan-Corp	SC 80 4 Ln, 3 Br Fr US 29 To SC 101	94.71	9/13/2002
	42.138B	Hebert	Reynolds	I-85 BS Grdrail Fr W To E Sptbg	94.34	1/31/2003
S	42.151B	Hebert	Sloan	Interstate Ramps	86.34	10/31/2002
S	42.2001.5			SC 357 Guardrail		
S	42.285A	Garber	Eagle	SC 295 Widen Fr SC 296 To US 221	76.80	10/31/2002
C	42.318A	Hebert/ Roark	Thrift Bros.	SC 296 Widen Fr SC 417 To S-64	73.14	1/19/2004
S	42.483	Garber	Let 5/14/02	S-41 @ S-499 Intersec	0.00	
S	42.484	Garber	Let 5/14/02	S-41 @ S. Willis Rd Intersec	4.00	
S	42.507A	Hebert	Sloan	US 29 Twin Br Ov CSX RR	30.55	4/19/2003
C	42.513A	Hebert/ Vinson	Thrift	SC 101 Fr I-85 To SC 417	8.48	11/7/2004
S	4753.107B	Wilson (Dist 4)	Oglesby Const	Prim/Sec Rts Pvmt Mrks in Dist 3 & 4	0.00	
S	4753.108B	Zettle	Eddins Elec	Dist 3 Traffic Signal Upgrade	0.00	6/30/2003
S	4753.113B	McCarter D4		D3&4 Pvmt Mrks Prim/Sec Rd		

SCDOT TENTATIVE LETTINGS

REVISED JAN '03

SUBJECT TO CHANGE WITHOUT NOTICE

Sorted by county and road name/route number

S C	COUNTY	ROUTE NO LOCAL NA	PIN	PROJECT NO FILE #/WORK TYPE	MI.	TERMINI

S=SCDOT C=CRM B=SCDOT/CRM

December 10, 2002 Primary

S C	COUNTY	ROUTE NO LOCAL NA	PIN	PROJECT NO FILE #/WORK TYPE	MI.	TERMINI
S	ANDE Knight	S- 279 WOODBURN ROAD	25330	BRT-BR04(009) **4.113B** REPL BR/APPROS	0.6	BR OV EIGHTEEN MILE CREEK 12.5 MI NW OF ANDERSON
S	PICK Cobb	SC 135	24336	STP-HE39(004) 39.100B CONSTRUCT TURN LANES IMPROVE INTERSEC.	1	RD S-235 RD S-325
	SPAR GREV Garber	SC 80 PH 2 VERNE SMITH PARKWAY Vinson	24624	SIB-GRID(011) 4223.100B GR/DR/PAVE (CONSULT)	2	SC 101 SC 14 (PHASE 2)
C	SPAR GREV Garber	SC 80 PH 2 VERNE SMITH PARKWAY Vinson	24624	SIB-GRID(011) 4223.100B.1 REPL BR/APPROS		SC 80 BRIDGE OVER UNNAMED CREEK
S	STATE		28331	SIB-SWCS(001) **4750.100B** STATEWIDE BARRIER SYSTEM	315.81	INTERSTATE CABLE BARRIER SYSTEM - CONTRACT AB
S	STATE		28333	SIB-USCS(001) **4758.100B** BARRIER SYSTEM	214.5	UPPER STATE INTERSTATE CABLE BARRIER SYS-CONT A

January 7, 2003 Primary

S C	COUNTY	ROUTE NO LOCAL NA	PIN	PROJECT NO FILE #/WORK TYPE	MI.	TERMINI
S	ANDE Knight	S- 258 SAFETY ON SECONDARY PRO	28473	SRP-S0SS 4.138B R/W WIDEN ROADWAY	1.4	INTERS OF RD S-258 & S-65 INTERS OF S-258 & S-104
S	GREV	S- 59	28239	STP-SM23(001) 23.180B SAFETY RESURFACE AND PVMT MRKS		US 276 US 25
S	GREV	S- 146	28240	STP-SM23(002) 23.181B SAFETY PVMT MRKS		RD S-50 RD S-154
S	SPAR	S- 58 SAFETY ON SECONDARY PRO	28488	SRP-165B **42.165B** WIDEN SHOULDER AND PAVE		ROAD S-187 NORTH CAROLINA STATE LINE
S	STATE	 TAPE MARKING FOR PATROL	28631	IM-TM88(002) **47.188B** INSTALL TAPE MARKINGS	50	VARIOUS INTERSTATE INTER- CHANGES THROUGHOUT SC

uary 11, 2003 Primary

S C	COUNTY	ROUTE NO LOCAL NA	PIN	PROJECT NO FILE #/WORK TYPE	MI.	TERMINI
	GREV Callenback	SC 14	22937	SIB-GRID(005) 23.478A GR/DR/PAVE WIDEN 3 LANES	5.7	SC 146 SC 417
S	OCON	SC 59	28731	STP-RFMT(185)	6.19	FAIRPLAY BOULEVARD

				37.116B RESURFACE		WEST OAK HIGHWAY
S	OCON	S-67	28912	SMP-SIMP 37.2003 RESURFACE		EXTENDING FR SC 11 ROAD S-20
	SPAR Hebert	SC 215	24068	STP-MODL(011) 42.541A GR/DR/PAVE (CONSULT)	2.2	1350' S OF OLD GEORGIA RD TAMARA WAY (PHASE I)

March 11, 2003 Primary

S	ANDE Knight	US 29 BS	27994	BR-RPRB(028) 4.132B BRIDGE REHAB.	0.08	OVER C&NW RR AND RD S-688 MURRAY STREET VIADUCT
S	GREV	US 29	24588	CAQ-CM23(014) 23.110B ADD LEFT TURN LANES		INTERSECTION WITH S-540 (SUBER ROAD)
S	GREV	S- 191 JONES MILL ROAD	25025	BRT-BR23(008) 23.121B REPL BR/APPROS	0.1	BR OV BIG DURBIN CREEK 2.5 MI N OF FOUNTAIN INN
S	SPAR	I- 26	27141	STP-D0T2(053) 42.154B LANDSCAPE (CONSULT)		AT THE STATE LINE AND SELECTED AREAS
S	SPAR	S- 60 TUCAPAU ROAD	25021	BRT-BR42(008) 42.117B REPL BR/APPROS	0.25	BR OV TRIB TO N TYGER RIVER 1 MI SE OF WELLFORD
S	SPAR	S- 62	26895	STP-HE42(007) 42.145B INSTALL FLASHING BEACONS		INTERSECTION AT RD S-83

March 11, 2003 Secondary

S	GREV CTC	S- 548 ROPER MOUNTAIN ROAD	26830	C 23.2000.5 RELOCATE ROADWAY		INTERSECTION WITH S-532

April 8, 2003 Primary

	GREV Arnell	I- 385 GEORGIA ROAD	18556	IU-IU23(001) 23.362A INTERCHG. AND MULTILANE		I-385/S-272 (GEORGIA RD, EXIT 29)
S	GREV Arnell	I- 385 GEORGIA ROAD	27788	IU-IU23(001) 23.362A.1 REPL BR/APPROS		BRIDGE OVER I-385
S	GREV Arnell	I- 385 HARRISON BRIDGE ROAD	16644	IU-IU23(002) 23.327A WIDEN UPGRADE INTERCHG. (CONSULT)	1.8	0.5 MI NW OF S-453 INTCHG 1.3 MI SE OF S-453 INTCHG
S	GREV Arnell	I- 385 HARRISON BRIDGE ROAD	16684	IU-IU23(002) 23.327A.1 REPL UNDERPASS (CONSULT)		UP UNDER S-543 (BR #3)
S	GREV Arnell	I- 385 HARRISON BRIDGE ROAD	16685	IU-IU23(002) 23.327A.2 BRIDGE (CONSULT)		BR OVER PAYNE BRANCH (BR #3A)
S	GREV	US 276	27575	STP-SA23(002) 23.171B REALIGN AND RESURFACE INTERSEC.		INTERSECTION OF SC 11 IN GREENVILLE COUNTY
S	GREV Callenback	SC 14	25555	STP-HE23(008) 23.129B ADD LEFT TURN LANES	0.3	INTERSECTION AT S-660
S	GREV	SC 86	24348	STP-HE23(006) 23.102B CONSTRUCT TURN LANES	0.3	INTERSECTION WITH RD S-52
S	GREV Hendricks	SC 253 MT. VIEW ROAD	25036	BRT-BR23(006) 23.124B REPL BR/APPROS	0.15	BR OV MEADOW CK 7.5 MI NE OF TRAVELERS REST
	OCON Cobb	S- 488 WELLS HIGHWAY	22823	BST-APCB(007) 37.108B MULTILANE	3.01	US 76/123 WEST OF SENECA SC RT 59
S	OCON Cobb	S- 488 WELLS HIGHWAY	24241	BST-APCB(007) 37.108B.1 RAILROAD BRIDGE	3.01	BR OVER NORFOLK SOU RR

S	OCON	S- 50 SECONDARY	28348	SRP-130B 37.130B WIDEN ROADWAY		SECTION OF RD S-50 FOR 0.40 MI S OF US 76/123
S	SPAR	US 29	27546	HMP-HIMP(202) 42.2001.2 CONSTRUCT TURN LANES		INTERSECTION OF US 29 AND SC 110
S	SPAR	SC 56	23591	STP-SA42(002) 42.524A IMPROVE ROADWAY	0.5	INTERSECTION AT ZIMMERMAN LAKE ROAD
S	SPAR	SC 215	26648	STP-M0DL(024) 42.143B GR/DR/PAVE (CONSULT)	1.4	2500' S OF US 221 (PH 2) 1350' S OF OLD GEORGIA RD
S	SPAR	SC 292	27538	HMP-HIMP(202) 42.2001.1 CONSTRUCT TURN LANES		TURN LANES ALONG SC 292 AND S-217.
S	SPAR	S- 55	27549	HMP-HIMP(202) 42.2001.3 CULVERT REPL		CULVERT REPLACEMENT ALONG S-55
April 8, 2003 Secondary						
S	SPAR	S- 31 2001-2002 HIMP	27359	C-CHMP 42.2001.6 INTERSEC. IMPROVE		INTERSECTION IMPS S-31 AND GOSSETT RD
May 13, 2003 Primary						
S	GREV	US 276 STATE PARK ROAD	27220	CAQ-CM23(020) 23.166B RECONST INTERSEC.		INTERSECTION W/RD S-22 AND POINSETT HIGHWAY (OS)
S	GREV	SC 290	27224	CAQ-CM23(021) 23.167B RECONST INTERSEC.		INTERSECTION W/SC 101
S	GREV	S- 147	23516	BRT-BR23(011) 23.495A REPL BR/APPROS	0.25	BRIDGE OVER CSX RR IN THE CITY OF GREENVILLE
	SPAR	I- 585	22996	SIB-GRID(007) 42.512A WIDEN GR/DR/PAVE (CONSULT)	6	NEAR DOWNTOWN SPARTANBURG I-85 RELOCATION
S	SPAR	US 176	27792	CM-CM42(011) 42.159B WIDEN FOR TURN LANES		INTERSECTION W/S-56 (OLD FURNACE ROAD)
May 13, 2003 Secondary						
S	PICK	SC 137	27847	C WIDEN TURN LANES		SC 137 AT SIX MILE SCHOOL
S	SPAR	SC 290 2001-2002 HIMP	27357	C-CHMP 42.2001.4 UTILITIES RELOCATE		UTILITY RELOCATION SC RT 290 AT TACAPAW RD
S	SPAR	S- 296 2001-2002 HIMP	27360	C-CHMP 42.2001.7 INTERSEC. IMPROVE		INTERSECTION IMPS ROAD S-296 AND S-62
June 10, 2003 Primary						
S	GREV CTC	S- 70	27465	HMP-HIMP(202) 23.2001.2 RECONST		ALG S-70 EXT FR ASHMORE BRANCH RD. N'ERLY
S	GREV	S- 272 GEORGIA ROAD	24596	CM-CM23(016) 23.112B ADD LEFT TURN LANES		INTERSECTION WITH S-453 (ROCKY CREEK ROAD)
S	GREV	S- 279 REID SCHOOLROAD	24592	CM-CM23(015) 23.111B IMPROVE ROADWAY		INTERSECTION WITH S-335 (EDWARDS MILL ROAD)
S	GREV	S- 545	27473	HMP-HIMP(202) 23.2001.1 CONSTRUCT TURN LANES		PT 1500' SE OF JONESVILLE RD CONT. 2000' NW
S	PICK	SC 124	27800	STP-HE39(005) 39.122B SIGNAL REALIGN AND TURN LANES		ALONG MAIN STREET
S	SPAR	US 29	27531	HMP-HIMP(202)		TURN LANES ALONG US 29 @

				42.2001 CONSTRUCT TURN LANES		ZION HILL ROAD
June 8, 2003 Secondary						
S	SPAR	S- 2 2001-2002 HIMP	27361	C-CHMP 42.2001.8 INTERSEC. IMPROVE		INTERSECTION IMPS RD S-2 AND PEARL STREET
July 8, 2003 Primary						
S	GREV	S- 166 BRUSHY CREEK	25029	BRT-BR23(004) 23.122B REPL BR/APPROS	0.15	BRIDGE OVER ENOREE RIVER 3.6 MI SW OF GREER
S	PICK Cobb	S- 61 OLD LIBERTY HIGHWAY	24379	BRZ-BR39(002) 39.101B REPL BR/APPROS	0.75	BR OV NORFOLK SOUTHERN RR 3 ME W OF EASLEY
July 8, 2003 Secondary						
S	GREV	SC 253 2002-2002 HIMP	27312	C-CHMP 23.2001.5 CONSTRUCT TURN LANES		TURN LANES SC RT 253 (CTC 215)
S	GREV	S- 272 2001-2002 HIMP	27315	C-CHMP 23.2001.8 INTERSEC. IMPROVE		INTERS IMPS S-272 AND F-41 (CTC 238)
S	GREV	S- 448 2001-2002 HIMP	27313	C-CHMP 23.2001.6 INTERSEC. IMPROVE		INTERS IMPS ALONG S-448 AND F-82 (CTC 236)
S	GREV	S- 564 2001-2002 HIMP	27316	C-CHMP 23.2001.9 INTERSEC. IMPROVE		INTERS IMPS ALONG S-564 AND S-440 (CTC 245)
August 12, 2003 Primary						
S	GREV	S-94 OLD SPARTANBURG ROAD	27605	HMP-HIMP(202) 23.2001.10 WIDEN LANE (CONSULT)	1.5	BRUSHY CRK RD (S-166) BATESVILLE RD (S-312)
S	GREV	S- 142 ADAMS MILL ROAD	25048	BRZ-BR23(012) 23.123B REPL BR/APPROS	0.5	BRIDGE OVER GILDER CREEK 4.6 MI E OF MAULDIN
S	SPAR	SC 292	24563	STP-HE42(006) 42.104B RECONST INTERSEC.	0.3	INTERSECTION WITH RD S-52
S	SPAR Roark	SC 296 PH 2	22518	BST-SIB-SPMB(002) 42.501A MULTILANE		RD S-64 SC RT 295 (PHASE 2)
September 9, 2003 Primary						
S	ANDE Knight Meetze	US 178 LIBERTY HIGHWAY	26947	BRT-BR04(011) 4.126B REPL BR/APPROS	0.75	BR OV THREE & TWENTY CRK 4.4 MI SE OF PENDLETON
S	GREV	S-453 HARRISON BRIDGE ROAD	27614	HMP-HIMP(202) 23.2001.11 WIDEN ROADWAY (CONSULT)		I-385 FAIRVIEW ROAD (S-55)
S	GREV	S-453 HARRISON BRIDGE ROAD	27613	HMP-HIMP(202) 23.2001.11.1 REPL BRIDGE (CONSULT)		2-LN BR OV UNNAMED CREEK
S	GREV	S-453	27461	HMP-HIMP(202) 23.2001.3 TURN LANES		A PT 500' W OF NEELY FERRY RD CONTINUING E'LY
S	PICK	S- 32	26508	BRT-BR39(005) 39.113B REPL BR/APPROS	0.2	BR OV TWELVE MILE CREEK 2.5 MI WEST OF PICKENS
C	SPAR Hendricks	SC 290	22992	SIB-GRID(009) 42.514A WIDEN GR/DR/PAVE	5.9	SC RT 296 US RT 221
September 9, 2003 Secondary						
	GREV	S- 333 2001-2002 HIMP	27314	C-CHMP 23.2001.7 INTERSEC. IMPROVE		INTERS IMPS AT RD S-333 AND S-48 (CTC 237)
October 14, 2003 Primary						
S	GREV	S-164 GIBB SHOALS ROAD	27178	BRT-BR23(014) 23.165B	0.5	BRIDGE OV ENOREE RIVER 4.7 MILES SOUTH OF GREER

				REPL BRIDGE		

December 10, 2003 Primary

S	ANDE Knight	S- 331	25984	MGE-SWMA(007) 4.2000.1 IMPROVE INTERSEC. CONSTRUCT TURN LANES		INTERSECTION AT US 29
S	PICK	US 178	28918	SMP-SIMP 39.2003.1 CONSTRUCT TURN LANES		AT THE INTERSECTION W/ RD S-204
S	PICK	SC 183	28914	SMP-SIMP 39.2003 CONSTRUCT TURN LANES		ALONG SC 183 AND S-162 2.5 MI WEST OF PICKENS
S	CHER SPAR	S- 42 LOVE SPRINGS ROAD	20039	BRZ-BR88(006) 11 42.604 REPL BR/APPROS (FAST TRK)	0.07	BR OV LITTLE THICKETTY CK 13.2 KM SW OF GAFFNEY
S	SPAR	S- 956 OLD MELVIN HILL ROAD	20142	BRZ-3042(044) 42.437A REPL BR/APPROS	0.34	BR OV NORTH PACOLET RIVER 11.3 KM E OF LANDRUM

January 13, 2004 Primary

S	GREV Cobb	US 25 WHITE HORSE ROAD	00707	APD-0035(126) 23.333A WIDEN 5 LANES GR/DR/PAVE		S-1047 (BROADWAY BOULEVARD) S-506 (MONTAGUE ROAD)
S	GREV	S- 920	27464	HMP-HIMP(202) 23.2001.4 TURN LANES		A PT 500' W OF STALLING CONTINUING 1000' EAST

March 9, 2004 Primary

S	GREV Hall	SC 418	26372	STP-SA23(001) 23.155B RELOCATE ROADWAY	0.75	NR S-625 (BURGESS SCH RD) NEAR LONG CANE LANE (COUNTY RD)
S	GREV	S-279 REID SCHOOL ROAD	18358	BRT-3023(013) 23.355A REPL BR/APPROS	0.15	BR OVER MOUNTAIN CK 7.6 KM W OF GREER
S	GREV	S- 337 TANNER ROAD	19921	BRZ-BR23(001) 23.391A REPL BR/APPROS	0.24	BR OVER MOUNTAIN CREEK 10.5 KM NE OF GREENVILLE
S	OCON Meetze	US 76 LONG CREEK HIGHWAY	27673	BRT-BR37(003) 37.125B REPL BR/APPROS		BRIDGE OV CHATTOOGA RIVER ON SC-GA STATE LINE

April 2004 Primary

S	PICK Cobb	SC 183 WALHALLA HIGHWAY	26939	BRT-BR39(007) 39.116B REPL BR/APPROS	0.85	BR OVER TWELVE MILE CREEK 2 MILES W OF PICKENS

July 2004 Primary

C	SPAR Freeland	SC 101 PH 2	22831	BST-APCB(009) 42.107B WIDEN	0.7	US 221 SC 417

October 12, 2004 Primary

C	GREV Amell Freeland	S- 333 VERDIN ROAD	22306	BST-GRMB(015) 23.466A WIDEN 5 LANES GR/DR/PAVE	0.6	EAST BUTLER ROAD SC RTE 146 (WOODRUFF RD)

November 11, 2004 Primary

C	GREV Amell Freeland	SC 146 WOODRUFF ROAD	22298	BST-GRMB(013) 23.464A WIDEN 5 LANES GR/DR/PAVE	1.9	LAURENS ROAD(US RTE 276) VERDAE BLVD
C	GREV Amell Freeland	SC 146 WOODRUFF ROAD	26454	BST-GRMB(013) 23.464A.1 REMOVE RAILROAD BRIDGE GR/DR/PAVE	1.9	LAURENS ROAD(US RTE 276) VERDAE BLVD
C	GREV Amell Freeland	SC 146 WOODRUFF ROAD	1633	BSG-GRMB(013) 23.464A.2 UPGRADE ROADWAY		UP UNDER SCL RR

uary 11, 2005 Primary

	SPAR Meetze	SC 9	28414	BR-BR42(016) 42.162B REPL BR/APPROS		BR OV OBED CREEK 9 MI NE OF INMAN
S	SPAR Meetze	SC 292 INMAN ROAD	28430	BR-BR42(018) 42.163B		BR OV NORTH TYGER RIVER 4 MILES NORTH OF LYMAN

				REPL BR/APPROS		
December 12, 2006 Primary						
C	ANDE	E-W CONNECT	24492	BST-ANMB(003)	3	US 76/178 (CLEMSON BLVD)
				4.103B		SC 81 (GREENVILLE HWY)
	Freeland			NEW LOC. ROADWAY (CONSULT)		
April 10, 2007 Primary						
S	PICK	SC 153 EXT.	23090		7	US 123
	Meetze			39		SC 183
				PRELIM. ENGINEERING		
S	PICK	US 123/SC 133	26057	BST-APCB(014)	0.5	NEW LOCATION TO INCLUDE NEW
	Meetze	CONNECTOR		39.111B		BR OV NORFOLK SO RAILWAY
				PRELIM. ENGINEERING		
S	OCON	S-402			1.7	US 76 / 123
	Meetze	SHEEP FARM ROAD		37		SC 28
				PRELIM. ENGINEERING		

S=SCDOT C=CRM B=SCDOT/CRM

Posted Wednesday, December 18, 2002 e-mail this story to a friend

County sets long-range road project priorities
Source: Greenville County Planning Commission

Route	From	To	Type of Improvement	Cost Estimate in 2002 dollars	GCPC Staff Recommendation
1. Batesville Road	SC 14	Woodruff Rd	Widen to 3 lanes	$14.6 Million	$14.6 Million
2. Bethel Road	Bridges Road	SC 14	Widen / Improve	$1.6 Million	0
3. East Butler Road	Main Street - Mauldin	Owens Lane	Widen to 5 lanes	$5.3 Million	0
4. East Lee Road	Edwards Road	Brushy Creek Road	Improve Intersections	$1.7 Million	0
5. Fairview Road	Harrison Bridge Road	SC 418	Widen to 3 Lanes, ROW for 5	$8.5 Million	0
6. Fork Shoals Road	Ashmore Bridge Rd	Old Augusta Rd	3 Lane widening, ROW for 5	$ 7.5 Million	$ 7.5 Million
7. Fork Shoals Road	Log Shoals Road	Ashmore Bridge Rd	3 Lane widening, ROW for 5	$4.9 Million	$4.9 Million
8. Garlington Road	Woodruff Road	Roper Mountain Road	Widen to 3 lanes	$8.6 Million	0
9. Harrison Bridge Road	I-385	Fairview Road	Widen to 5 lanes	$ 3.9 Million	$ 3.9 Million
10. I-385	Woodruff Road	I-85	Widen, Provide auxiliary Lanes	$ 15 Million	0
11. I-85	Woodruff Road	Pelham	Add/Extend Decel/Storage Lane	$3.7 Million	$3.7 Million
12. Laurens Road	I-85	Fairforest Way	Upgrade to a true 5 lane	$2.7 Million	$2.7 Million
13. Pine Knoll Drive	Wade Hampton Boulevard	Waddell Road	Improve / Upgrade Roadway	$1.8 Million	0
14. Roper Mountain	Garlington	SC 14	Widen to 3	$ 5.2	$ 5.2 Million

Road	Road		lanes	Million	
15. Roper Mountain Road	Roper Mtn Ext	Garlington Rd	Widen to 3 Lanes	$ 7 Million	$ 7 Million
16. Roper Mountain Road	SC 14	Godfrey Rd	Widen to 3 lanes	$4.3 Million	$4.3 Million
17. Roper Mountain Road	Woodruff Road	I-385	Intersection Improvement @ Roper Mtn/Woodruff	$1.1 Million	0
18. SC 20	SC 86	I-185	Widen to 5 lanes	$12.7 Million	0
19. SC 253	N. Franklin Road	Perry Road	Widen from 4 lanes to 5	$3 Million	0
20. SC 86	US 25	SC 20	Widen to 5 lanes	$18.9 Million	$15.3 Million
21. Scuffletown Road	Woodruff Road	Jonesville Rd	Widen to 3 lanes	$6.8 Million	$6.8 Million
22. Stone Avenue	East Park Avenue	Rutherford St	Upgrade to a true 5 lane	$21.5 Million	$21.5 Million
23. West Georgia Rd	Neely Ferry Rd	Fork Shoals Rd	Widen to 3 lanes acquire ROW for 5	$14.5 Million	$18 Million
24. Woodruff Road	I-85	I-385	7 lane widening	$ 16.4 Million	0
25. Woodruff Road	Verdae Boulevard	I-85	Intersection Improvement at Flatrock	$ 2.5 Million	$ 2.5 Million

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PURDUE UNIVERSITY STUDY

COST SAVINGS ON HIGHWAY PROJECTS UTILIZING SUBSURFACE UTILITY ENGINEERING

Prepared by
Purdue University
Department of Building Construction Management

December 1999

Prepared for the
Federal Highway Administration
Washington, DC

FHWA Contract Number DTFH61-96-00090

NEXT PAGE

PURDUE UNIVERSITY STUDY

TABLE OF CONTENTS

ABSTRACT

The Federal Highway Administration (FHWA) has been promoting the use of subsurface utility engineering (SUE) since 1987 as a means to save costs on highway construction projects. In 1996, the FHWA commissioned Purdue University to study the cost savings from four states' dots that routinely utilize utility quality levels while producing contract drawings.

A total of seventy-one projects (71) from Virginia, North Carolina, Texas, and Ohio were studied. The total construction costs of these projects were in excess of one billion dollars. These projects involved a mix of Interstate, Arterial, and Collector Roads in urban, suburban, and rural settings. DOT project managers, utility owners, constructors, and designers were interviewed. Two broad

category of savings emerged: quantifiable savings and qualitative savings.

A total of $4.62 in savings for every $1.00 spent on SUE was quantified. Qualitative savings were non-measurable, but it is clear that those savings are also significant and may be many times more valuable than the quantifiable savings. Only three projects returned less in savings than expenditures. This leads to the conclusion that SUE is a viable technologic practice that reduces project costs related to the risks associated with existing subsurface utilities and should be used in a systemic manner.

Keywords: subsurface utility engineering, utility mapping, utility quality levels, Purdue University, construction risk management, value engineering, SUE

EXECUTIVE SUMMARY

The Federal Highway Administration (FHWA) commissioned Purdue University to study the effectiveness of subsurface utility engineering (SUE) as a means of reducing costs and delays on highway projects. The effectiveness study was conducted and the results and accompanying recommendations are presented here. The concepts and practice of SUE have been developed and refined over many years, but basically were systematically put into professional practice in the 1980s. Several states have programs whereby the state Department of Transportation (DOT) contracts with SUE providers to map utilities on their projects.

Subsurface utility engineering is the convergence of new site characterization and data processing technologies that allows for the cost-effective collection, depiction, and management of existing utility information. These technologies encompass surface geophysics, surveying techniques, mapping techniques, CADD/GIS systems, *etc.* Rather than disclaiming responsibility for existing utility information, subsurface utility engineers certify utility information in accordance with a standard classification scheme (utility quality levels) that allows for a clearer allocation of risk between the project owner, project engineer, utility owner, and constructor

Previous studies and statements of cost savings were performed by various state DOTs, providers of SUE services, and the FHWA. Commissioning Purdue University to conduct this study allowed for an independent and impartial review and study of costs savings.

Virginia, North Carolina, and Ohio were initially selected to be part of this study. Texas was added due to their rapidly growing SUE program. These four states had a total of 71 projects studied in detail. These projects were selected randomly from a list of projects that utilized SUE. They involved a mixture of Interstate, arterial, and collector roads in urban, suburban, and rural settings. DOT project managers and engineers, utility owners, constructors, designers, and subsurface utility engineers were interviewed.

Wyoming, Puerto Rico, and Oregon were given *seed* money from the FHWA to try SUE on a select project. These projects are also included in the study (see Appendices), although data from these projects are extremely limited. Finally, several other states have studied their own projects or programs and have supplied information for this study. Overall, approximately one hundred projects were evaluated in some level of detail in order to accomplish the FHWA study mission.

A savings of $4.62 for every $1.00 spent on SUE was quantified from a total of 71 projects. These projects had a combined construction value in excess of $1 billion. The costs of obtaining Quality Level "B" (QL B) and Quality Level "A" (QL A) data on these 71 projects were less than 0.5 percent of the total construction costs, and it resulted in a construction savings of 1.9 percent over traditional Quality Level C (QL C) and/or Quality Level D (QL D) data. Qualitative savings were non-measurable, but it is clear that those savings are also significant and may be many times more valuable than the quantifiable savings.

The figure $4.62 is somewhat less than the $7.00 to $1.00 (Previous Virginia DOT study), $18.00 to $1.00 (previous Maryland DOT study), and $10.00 to $1.00 (Society of American Value Engineers) returns on investment that were previously reported in the literature. However, the quantity of studied projects is much higher; the projects are more random in nature; and no qualitative costs were included in the total. Indeed, one individual project had a $206.00 to $1.00 return on investment (North Carolina DOT). Only 3 of 71 projects had a negative return on investment.

The simple conclusion of this study is that SUE is a viable technologic practice that reduces project costs related to the risks associated with existing subsurface utilities and, when used in a systemic manner, will result in significant quantifiable and qualitative benefits. Using the SUE savings factor data from this study and a national expenditure in 1998 of $51 billion for highway construction that was provided by the FHWA, the use of SUE in a systemic manner should result in a minimum national savings of approximately $1 billion per year.

REPORT

Scope of Study

The Federal Highway Administration (FHWA) commissioned Purdue University to study the effectiveness of subsurface utility engineering (SUE) as a means of reducing costs and delays on highway projects. The effectiveness study was conducted and the results and accompanying recommendations are presented here. The concepts and practice of SUE have been developed and refined over many years, but basically were systematically put into professional practice in the 1980s. Several states have programs whereby the state Department of Transportation (DOT) contracts with SUE providers to map utilities on their projects.

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Wyoming, Puerto Rico, and Oregon were given *seed* money from the FHWA to try SUE on a select project. These projects are also included in the study (see Appendices), although data from these projects are extremely limited. Finally, several other states have studied their own projects or programs and have supplied information for this study. Overall, approximately one hundred projects were evaluated in some level of detail in order to accomplish the FHWA study mission

Overview

Many design and construction projects are taking place in areas where an abundance of underground utilities already exists such as in cities, process plants, airports, highways, and so forth. These existing utilities create risks for the project owner, designer, and constructor. Although there are many reasons for these risks, one of the fundamental reasons is that accurate data on the location, and even sometimes on the existence of these *out-of-sight* utilities, are rare. Existing records of underground site conditions are usually incorrect, incomplete, or otherwise inadequate because:

- They were not accurate in the first place: design drawings are not *as-built*, or installations were *field run* and no record was ever made of actual locations;
- On old sites, there have usually been several utility owners, architects/engineers, and contractors installing facilities and burying objects for decades in the area. Seldom are the records placed in a single file, and often they are lost. There is almost never a composite;
- References are frequently lost: records show that an object is a certain distance from a building that is no longer there, or an object is a certain distance from the edge of a two-lane road that is now four lanes or is part of a parking lot;

- Lines, pipes, and tanks are removed from the ground, but aren't removed from the drawings.

Engineers recognize this problem of records with incorrect or incomplete information, and attempt to protect themselves through prominently displayed notes on the drawings. Although these notes may vary in wording, a typical example is as follows:

Utilities depicted on these plans are from utility owner's records. The actual locations of utilities may be different. Utilities may exist that are not shown on these plans. It is the responsibility of the contractor at time of construction to identify, verify, and safely expose the utilities on this project.

Contractors may employ multiple mechanisms to protect themselves. Certainly, the types of excavation equipment used can be important. All states now have a *one-call* statute in place whereby the contractor must call all known utility owners before construction begins. Utility owners then have the burden of marking their utilities on the ground surface for damage prevention purposes. Many times, the *paint* marks indicating the location of the utilities do not agree with the utilities depicted on the design plans. Contractors know this will happen and typically increase their bid price to account for this contingency. They will also ask for change orders and claims when necessary. Usually the project owner is obligated to pay these change orders and claims due to utilities being treated as a *differing or unknown site condition* in the standard contract documents. Some states allow the contractor to seek relief from the designer even though there is no contract between the contractor and the engineer.

Project owners rarely end up with any protection for unknown, unrecorded, or mis-recorded utility data. Savvy project owners are beginning to realize this fact. They are either requiring their engineers to take some responsibility for more accurate utility information or they are hiring specialty engineering firms to obtain more accurate information.

A convergence of new site characterization and data processing technologies now allows for the cost-effective collection and depiction of existing utility information. These technologies encompass surface geophysics, surveying techniques, CADD/GIS systems, etc. This convergence is now known as subsurface utility engineering. Rather than disclaiming responsibility, subsurface utility engineers collect utility data and certify its quality. The accepted definition of subsurface utility engineering is:

A practice of engineering that manages the risks associated with subsurface utilities via: utility mapping at appropriate quality levels, utility coordination, utility relocation design and coordination, utility condition assessment, communication of utility data to concerned parties, utility relocation cost estimates, implementation of utility accommodation policies, and utility design.

In order to understand SUE, it is important to first define the quality levels of utility information that are available to the design engineer, constructor, and project owner. The concept of quality levels was developed from the realization that sometimes more reliable information on the location of underground utilities is known to the engineer, but is not typically presented within any documents for the benefit of others. Examples of the wide range of notations made include a gas line for which there exists a certified reference to recoverable survey control portrayed in the same manner as a water line for which there is only a verbal recollection by a water company representative.

Four separate quality levels of utility information are now generally recognized by various organizations. The Federal Highway Administration has taken the lead in promoting and using this concept. Other organizations such as the American Society of Civil Engineers (ASCE), Federal Aviation Agency (FAA), Network Reliability Council, various state DOTs, county governments, and so forth have also used this concept.

The generally accepted definitions are as follows.

- Quality Level D (QL D): Information derived solely from existing records or verbal recollections.
- Quality Level C (QL C): Information obtained by surveying and plotting visible above-ground utility features and by using professional judgment in correlating this information to Quality Level D information.
- Quality Level B (QL B): Information obtained through the application of appropriate surface geophysical methods to identify the existence and approximate horizontal position of subsurface utilities. "Quality level B" data are reproducible by surface geophysics at any point of their depiction. This information is surveyed to applicable tolerances and reduced onto plan documents.
- Quality Level A (QL A): Information obtained by the actual exposure (or verification of previously exposed and surveyed utilities) of subsurface utilities, using (typically) minimally intrusive excavation equipment to determine their precise horizontal and vertical positions, as well as their other utility attributes. This information is surveyed and reduced onto plan documents. Accuracy is typically set at 15mm vertical, and to applicable horizontal survey and mapping standards.

Determining which quality level must be met is an important responsibility of the project owner. In other words, if the owner specifies lower-quality information to the design engineer, the owner must be willing to pay for the associated costs in project delays, bid contingencies, change orders, unnecessary utility relocations, redesign, and perhaps utility damage and other problems. Most projects currently proceed by owner specification at Quality Level C whether or not the owner realizes it. However, engineers should encourage owners to specify higher levels, and inform owners that they may incur liability for lower-quality level depictions.

On projects where owners specify a desire for the highest-quality level of utility information, decisions and judgments must be made by the parties as to costs versus anticipated results. These decisions and judgments will require a thorough knowledge of existing surface geophysical techniques, their costs, and their limitations. Engineers will recommend and apply appropriate techniques based upon owner budgets and expectations. Decisions and judgments must also be made as to where Quality Level A data should be provided. Finished plans may contain utility data with different quality attributes--all four quality levels may be represented.

Benefits

There are numerous benefits obtained when using SUE on highway projects. By using SUE, significant benefits are derived for the DOT, utility companies, SUE consultants, contractors, and the general public. Some of the benefits that have been obtained are as follows:

- Reduction in unforeseen utility conflicts and relocations;
- Reduction in project delays due to utility relocates;
- Reduction in claims and change orders;
- Reduction in delays due to utility cuts;
- Reduction in project contingency fees;
- Lower project bids;
- Reduction in costs caused by conflict redesign;
- Reduction in the cost of project design;
- Reduction in travel delays during construction to the motoring public;
- Improvement in contractor productivity and quality;
- Reduction in utility companies' cost to repair damaged facilities;
- Minimization of utility customers' loss of service;
- Minimization of damage to existing pavements;
- Minimization of traffic disruption, increasing DOT public credibility;
- Improvement in working relationships between DOT and utilities;
- Increased efficiency of surveying activities by elimination of duplicate surveys;
- Facilitation of electronic mapping accuracy;
- Minimization of the chance of environmental damage;
- Inducement of savings in risk management and insurance;
- Introduction of the concept of a comprehensive SUE process;

- Reduction in Right-of-Way acquisition costs.

Types of Costs

The reductions in risk for projects utilizing SUE have been difficult to quantify. There are many variables and scenarios that may occur. Historical data is difficult to come by. Some savings are easily quantified; others may be qualitative or speculative in nature. This study categorizes savings accordingly. These types of costs are:

- Exact costs that can be quantified in a precise manner. Examples are costs much like the costs for test holes, the cost to eliminate construction and utility conflicts, or any other cost for which exact figures can be obtained.
- Estimated costs that are difficult to quantify, but can be calculated with a high degree of certainty. These costs were estimated by studying projects in detail, interviewing the personnel involved in the project, and applying historical cost data.
- Costs that cannot be estimated with any degree of certainty due to a lack of data. These are true qualitative costs and may in fact be significant to the real cost savings. These qualitative costs are not quantified in the evaluation study.

Evaluation Plan

Three primary methods were used to examine, study, and collect data on the application of SUE.

- Conduct an analysis of the overall program of SUE within each study state. This approach involved a cursory examination of all projects utilizing SUE within a particular state.
- Select and study individual projects. These projects were selected with input from appropriate Departments of Transportation to obtain, as best possible, a mix of projects ranging from simple to complex. One of the selection criteria was to select projects that the designers, constructors, and users were still available to contact and interview.
- Use a modified combination of the above approaches to analyze SUE. Application of this approach depends on the states being studied. The methods used were specific project analysis where available, and program analysis for overall conclusions.

Some of the items investigated during the interviews and analysis were old utility records and locations (Quality Level D and C information). They were compared to the new upgraded locations (Quality Level B and A information and the differences were compared to determine the benefits of SUE. The guiding concept utilized with this approach was to obtain data and information on SUE activities from the people who actually were involved in the project.

In addition to conducting interviews and reviewing the available and utilized quality levels and their project impacts, the available paper trail was also investigated. For example, similar projects that used and did not use SUE were examined for existence and quantities of change orders, extra work orders, delay and other claims, time extensions, etc. State and Federal tracking forms for allocation of costs for utility relocations, prior rights, and correspondence were valuable to the study.

Results

Virginia

The Virginia Department of Transportation estimates an annual expenditure of approximately $10 million on SUE in a variety of contracting methods. Virginia has three SUE firms under contract to provide utility mapping (all quality levels) in nine separate districts. Additionally, the DOT's statewide and regional survey contracts require QL B mapping for select projects. There are two regional consultants providing utility coordination services. There are four regional consultants providing utility relocation design. Certain large projects have subsurface utility engineering (utility mapping, utility coordination, and relocation design) built in to the project requirements. All highway projects in Virginia are required to use SUE, and most projects utilize Quality Levels A and B information. SUE information has also proven useful to utility companies in their relocation design.

Virginia started their program in 1984. Virginia has the most comprehensive program in the nation. They utilize every aspect of SUE with a combination of in-house and consultant forces. They estimate a project delivery time savings of 12 percent-15 percent has resulted from their systemic approach to utility risk management. Utility owners have been more cooperative after the DOT SUE program commenced. Quality level B mapping identifies an average of 10 percent - 50 percent more utilities than traditional mapping (QL D and QL C).

North Carolina

The North Carolina Department of Transportation (NCDOT) began a subsurface utility engineering program in 1991, after studying the successes of Virginia, Delaware, and Pennsylvania's programs. SUE began as a trial program by NCDOT and has gradually evolved into a continuous process. The primary reason for utilizing SUE in North Carolina is to reduce the cost of highway construction. Cost reduction can be obtained through the elimination or reduction of claims, change orders, and construction delays, and through the minimization of disruption to utility services.

SUE began as an aid to in-house-designed projects with an initial contract with one provider valued at approximately $300,000. The program was successful and, as a result, additional SUE consultants were brought under contract. Currently there are four providers; however, the contract values are not equal. For designs performed by outside consultants, i.e., non-state employees, the DOT requires that the outside designers hire one of the four state-DOT-approved SUE consultants for their team. Consequently, the two contracting methods, i.e., state contract for in-house design and project contract for outside-consultant design, result in a total, state, DOT SUE program valued at approximately $3,000,000 per year. This represents a SUE budget of approximately 2 percent of the total state engineering/ construction budget.

When SUE was initially utilized in North Carolina, a formal review procedure was adopted that was used for one or two periods. The use of the procedure was informally abandoned for no given specific reason. SUE is now employed in North Carolina by an informal procedure based on cooperation between design engineers and area engineers. This informal procedure is accomplished by mutual agreement and judgment between design and area engineers on an as needed project basis due to amount of utilities, potential impact, and engineering judgment. Now that many of the design and area engineers have become familiar with the concepts of SUE, the informal process is working well.

NCDOT only utilizes the utility mapping components of SUE. So far, the NCDOT handles utility coordination and utility relocation design with in-house forces. There has been some discussion to attempt a trial project where all aspects of SUE are performed by a SUE consultant. This would include utility mapping, utility coordination (with utility owners), and perhaps some utility relocation design for publicly owned utilities.

The evaluation study has computed a cost savings of $6.63 for every dollar spent for SUE in North Carolina. The total amount of expenditures to date for SUE in North Carolina is $8,725,371.97. This represents a projected savings of $57,849,211.39 since the SUE process was started in North Carolina. The SUE savings computed in this study are related to the in-house projects designed and constructed by the NCDOT.

NCDOT appears to have figured out how to use SUE effectively in their state and are doing so for the benefit of the taxpayer and ratepayer. NCDOT has utilized SUE for eight years, with a progressive amount of contract value. They are currently funding SUE at levels in excess of $3 million per year. It is difficult to estimate non-quantifiable savings resulting from decreased utility damages, bid prices, construction delays, and so forth; however, quantifiable savings (after studying about 7 percent of NCDOT's in-house projects on both a cost and project basis, indicating a return in excess of $6.60 for every dollar spent) were obtained.

Therefore, a quantifiable savings per year for NCDOT projects is approximately $19.8 million. The majority of projects utilizing SUE showed no delays due to utility conflicts, an improvement over past engineering practices.

<u>Ohio</u>

The development of Subsurface Utility Engineering (SUE) in Ohio was started in 1992 with a trial project in the city of Columbus. In May 1995, after evaluation of that project's success, the FHWA funded SUE through a demonstration-projects mechanism for the Ohio Department of Transportation (ODOT).

The primary reason for utilizing SUE in Ohio is to reduce the cost of highway construction. Cost reduction is obtained through the elimination or reduction of claims, change orders, and construction delays, and through the minimization of disruption of utility services. SUE was initially used to solve field utility conflict questions; subsequently it has evolved into some design processes.

Ten of the twelve Districts in Ohio have used SUE on at least one project. Due to successes in the urban districts of Cleveland and Akron/Canton, these two Ohio districts have their own SUE contracts, while the other ten districts share a statewide contract. In Cleveland and Akron/Canton Districts, the Production Department (essentially design and construction) selects projects for SUE. This has evolved today to include virtually every project. In the other districts employing SUE, the District Utility Coordinator selects projects for the use of SUE with input from construction departments. The District Utility Coordinator informs the Central Office who administers the SUE contract and assigns a SUE provider to the District's project on an alternating basis. The provider then sends the district an estimate for SUE services, based on the scope specified by the District Utility Coordinator. The Central Office then formally assigns the project to the SUE provider.

One advantage of this system is that the districts do not have to allocate funds for SUE before the use of SUE. The Central Office supplies the funds, and then back-charges the districts only for those actual SUE expenditures. When using Central Office Funds, the districts do not need to be concerned about losing funds if they are not used. The disadvantages of this system include less local control of SUE services, no choice in SUE providers, and (typically) a less timely procurement of SUE services in the design phase of projects.

Overall, the savings analysis for Ohio was determined to be $5.21 for every dollar expended for SUE. The fourteen projects included in this Ohio SUE evaluation total $284,349,202.07 in construction costs. The net SUE savings (SUE savings less the cost of SUE) is $3,418,069.47.

Applying the ratio of net SUE savings to the construction cost of the SUE evaluation projects yields an annual projects savings of $12,080,000 based on the total highway construction amount.

Texas

In 1994, the FHWA sponsored a series of informational briefings on Subsurface Utility Engineering (SUE). These one-day briefings were held in the five largest TXDOT Districts. The briefing team was comprised of Paul Scott (FHWA Headquarters), Lee Gibbons (FHWA Division), Joe Bissett (MDSHA), and Jim Anspach (So-Deep).

As a result of these briefings, TXDOT began the process of developing a SUE program. The Right-of-Way Division was the spearhead for this program after hearing about SUE from the briefings and the conferences. The Right-of-Way Division was able to initiate SUE knowing that the design benefits would result in SUE becoming a part of the total project process.

In 1995, a Request-for-Proposals (RFP) was published. In 1997, four SUE providers were selected to provide Quality Level B (QL B) and Quality Level A (QL A) mapping services on a state-wide basis. Initial, combined contract values of $4,000,000 over two years were increased to $9,000,000 over 28 months due to good results and the subsequent internal demand.

In 1999, six new contracts totaling $9,000,000 were let for a 3-year term. The SUE program in Texas depends on the district involved and is limited to Interstate (On-System) projects with no municipal or local projects involved. SUE in Texas may be used on any construction project on the state highway system. It is TXDOT's intent to encourage their engineering design consultant community to begin using Subsurface Utility Engineering on these Off-System projects that are more urban in nature, and therefore potentially more utility-complex. TXDOT is now firmly committed to SUE and plans to encourage its use in all districts.

When SUE was initially utilized in Texas in 1997, the Right-of-Way Division began to develop an informal review procedure. This informal procedure is accomplished by mutual agreement and judgment among the Right-of-Way Division, design, and area engineers on an *as needed project basis* regarding the extent of underground utilities, potential impact, and engineering judgment. After the need for SUE is *scoped* by the Right-of-Way Division, the particular district working with the Right-of-Way Division in a team effort decides on the need for SUE. The SUE contract is then administrated from the Right-of-Way Division who manages the contracts with the 6 SUE providers (6 as of August 1999).

As of October 14, 1999, 146 SUE projects have been accomplished in Texas. Now that many of the design and area engineers have become familiar with the concepts of SUE, the informal process is working well.

Twenty-seven (27) projects were studied in detail to collect data and information on time, cost, user, and risk management savings. The evaluation study was then able to compute a cost savings of $4.27 for every dollar expended for SUE. In this study, SUE is considered to be the use of Quality Level A and Quality Level B Utility Data, as opposed to the traditional Quality Level C and Quality Level D Utility Data. Based on the SUE savings analysis, a projected savings of $108,308,000 is the potential savings to the Texas DOT statewide, if all projects utilize Quality Level B and Quality Level A data, based on the amount of highway construction typically under contract. Based on Fiscal Year 99 construction contract amounts and current performance levels from SUE providers, the potential current annual savings is projected to be $66,092,000.

Conclusions

The Federal Highway Administration (FHWA) commissioned Purdue University to study the effectiveness of subsurface utility engineering (SUE) as a means of reducing costs and delays on highway projects. From a study of 71 projects with a combined construction value in excess of $1 billion, the results indicated the effectiveness of the study was a total of $4.62 in savings for every $1.00 spent on SUE. The costs of obtaining QL B and QL A data on these 71 projects were 0.5 percent of the total construction costs, resulting in a construction savings of 1.9 percent by using SUE. Qualitative savings were non-measurable, but it is clear that those savings are also significant and may be many times more valuable than the quantifiable savings.

This is somewhat less than the $7.00 to $1.00 (previous VDOT study), $18.00 to $1.00 (previous MDSHA study), and $10.00 to $1.00 (Society of American Value Engineers) returns on investment that were previously reported in literature. However, the quantity of studied projects is much higher; the projects are more random in nature; and no qualitative costs were included in the total. Indeed, one individual project had a $206.00 to $1.00 return on investment (NCDOT). Only three of 71 projects had a negative return on investment. This leads to the conclusion that SUE is a viable technologic practice that reduces project costs related to the risks associated with existing subsurface utilities and should be used in a systemic manner. Using the SUE savings factor data from this study and a national expenditure in 1998 of $51 billion for highway construction that was provided by the FHWA, the use of SUE in a systemic manner should result in a minimum national savings of approximately $1 billion per year.

Recommendations

There are several recommendations on state DOT subsurface utility engineering programs that can be justified based upon the following factors.

- A review of many state DOT subsurface utility engineering programs.
- Conversations with state and private practice engineers.
- A review of available literature.
- Personal attendance at many national, regional, and local functions pertaining at least in part to subsurface utility engineering over the past three years.

Some state DOT programs already incorporate these recommendations as common practices. Other states should consider implementing them in whole or part in order to keep up with the evolving field of subsurface utility engineering, the proven cost savings that result from such practices, and the changing liabilities created from existing subsurface utilities.

These recommendations are in no particular order:

- Establish subsurface utility engineering as a pre-qualification category for engineering services. Use appropriate criteria as a basis for pre-qualification. Remember that the FHWA, AASHTO, and the ASCE among others all consider this a professional engineering service with multi-disciplinary aspects.
- Develop statewide, regional, and/or District subsurface utility engineering contracts for DOT in-house and/or consultant-designed projects.
- Consider including subsurface utility engineering as a prequalification category in consultant RFPs.
- Administer or make components of subsurface utility engineering available within the appropriate DOT organizational sections. For example, utility mapping and utility avoidance consulting is best performed within the Design section; utility coordination and utility relocation design may be more appropriate within the Right-of-Way/Utility sections. Preliminary utility cost estimates may be appropriate in the Project Planning section. Utility as-builting, utility damage prevention assistance, pre-bid utility data communication, and claims assistance may be appropriate in the Construction section.
- Consider upgrading all projects to QL B and QL A data as a project self-insurance mechanism. This study shows that the benefits far exceed the costs on average. Trying to select only those projects that may end up with significant utility problems is risky at best.
- Consider unit pricing for utility mapping functions as a contract mechanism. It is easy to administer, easy to audit for billing accuracy, and easy to budget estimated project costs.
- Develop a program of continuing education for DOT design personnel and constructors on subsurface utility engineering and its benefits.
- Consider utilizing all aspects of subsurface utility

engineering rather than only the utility mapping component (see Virginia DOT's program).

- Remain abreast of new developments in the field, e.g., American Society of Civil Engineers' pending national standards, AASHTO's Best Utility Practices Guide, etc.
- Encourage Local/Municipal Planning Organizations to use subsurface utility engineering. Their projects are usually more urban in nature and can accrue generally higher benefits than rural projects.
- On plans, place a general note that spells out that subsurface utility engineering utility mapping Quality Levels B and A were utilized on this project. The type and existence of utility quality levels should also be indicated in the legend.

More Information

Free copies of the entire report may be obtained from:

Paul Scott
Highway Engineer (Utilities Coordinator)
Federal Highway Administration
Office of Program Administration (HIPA-20)
400 Seventh Street, SW., Room 3134
Washington, D.C. 20590
(202) 366-4104
(202) 366-3988 fax
paul.scott@fhwa.dot.gov

- Download this document (self extracting zip 43 kb)
- Return to SUE Publications

SCDOT

South Carolina
Department of Transportation

District Three Engineering
252 South Pleasantburg Drive
Greenville, South Carolina 29607
864-241-1010 • FAX 864-241-1115

Anderson County
Oconee County
Pickens County
Greenville County
Spartanburg County

LET SUE HELP YOU!
Coordination, Cooperation and Communication

The South Carolina Department of Transportation (SCDOT) cordially invites you to attend a meeting regarding the Subsurface Utility Engineering (SUE) program.

When: **Wednesday, November 13, 2002**
Time: **10:00 AM – 12:00 noon**
Location: **SCDOT District Three**
4th Floor Conference Room
252 South Pleasantburg Drive
Greenville, SC 29607

The Purpose of the meeting is:

- Provide information on Subsurface Utility Engineering (SUE).
- Provide utility owners with information on "1 + 2" bidding and "in contract" utility relocation.
- Provide information resources for projects in your area.
- Receive feedback on partnering and communication efforts.

SCDOT requests that you complete and return the CCC Questionnaire that was e-mailed to you October 29, 2002 at or before the meeting on November 13th.

If you and/or others from your organization plan to attend, please RSVP via e-mail at ryggsre@scdot.org or phone 864-241-1010.

Thank you in advance for your cooperation, time and effort in providing a safer and more efficient transportation system for the people of South Carolina. If you have any further questions, please do not hesitate to contact us.

Sincerely,

Robert E. Ryggs
District Utility Coordinator

SCDOT
South Carolina
Department of Transportation

District Three Engineering
252 South Pleasantburg Drive
Greenville, South Carolina 29607
864-241-1010 FAX 864-241-1115

Anderson County
Oconee County
Pickens County
Greenville County
Spartanburg County

Coordination, Cooperation and Communication Questionnaire

The following questions and scenarios are designed to promote thought and discussion and encourage positive problem solving. Please respond to the ones that apply to your company and their relationship with the DOT. Thank you for your participation in this important project.

1. Utility Type: Name & Company (Optional):

2. In a project you were involved with that experienced significant delays due to utility relocation, what might have been done differently in the various stages of the project to avoid these delays?

3. How can we work together to reduce traffic delays, minimize service disruptions and provide a safe environment for all?

4. What might the DOT be able to do to encourage and facilitate earlier utility engineering and relocation? What tools do you need from the DOT to get the job done in a timely and efficient way?

5. What conflicts do you encounter that could cause delays? (i.e.) Hurricane knocks out power in neighboring state and the electric company pulls off the project and goes into emergency operation in that area. Gas main cannot be shut off in peek cold weather.

6. What process(es) could your agency implement to minimize or avoid utility relocation-related delays?

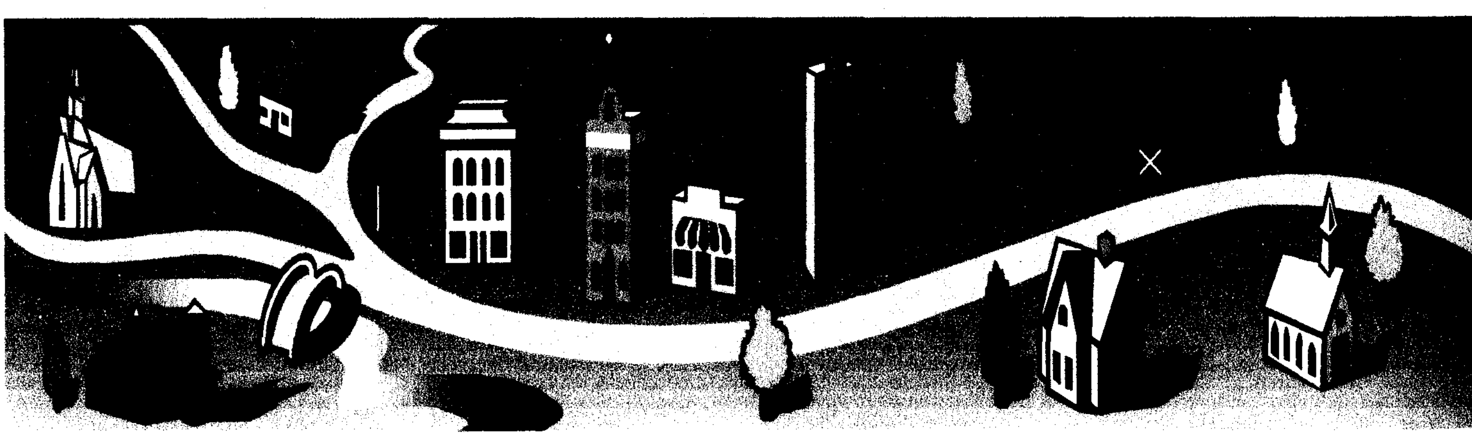
7. Would your company be able to submit agreements and/or relocation sketches two (2) months prior to the letting? How much lead time do you need to accomplish this?

8. If the contractor were to clear and grub, and pull off the project for 30-60 days, would you be able to complete your work in that time period?

9. What can be done to improve and implement better communication, coordination and cooperation?

10. What issues or problems need addressing for the DOT to include in the roadway/bridge contract to have the roadway/bridge contractor to do the utility relocation work for you? (This would include water and sewer lines, telecommunication conduit and pull boxes.)

4TH FLOOR CONFERENCE ROOM



S.U.E. RESEARCH

The research aspect of the S.U.E. project included both a survey/questionnaire and a follow-up meeting with high-level utility vendors. The questionnaire was sent to the full spectrum of utilities (i.e. CATV, electric, communications, gas, etc.) as well as SCDOT engineers. The follow-up meeting involved the same people, and was well received. The purpose of the research was two fold: (1) to get much needed input on the utility relocations, and (2) to gauge cooperation/communication from the utilities toward S.U.E.

(See attached for actual survey and responses.)

The survey responses were varied, but there was some consensus among the respondents on certain subjects.

- **Lead-time**. The consensus seemed to be about six to eight months of lead-time was necessary to fulfill all aspects of utility relocation. Obviously, the earlier they are given accurate final plans, the better they are able to meet their obligations.
- **Right-of-way acquisition**. Several of the utilities expressed difficulty in obtaining right-of-way for their relocations. SCDOT by law may only acquire enough right-of- way for the roadway/bridge project. Coordinating the approach of the property owner together or sharing the research information so as to not duplicate efforts would help this matter.
- **Safety**. Many of the respondents noted a concern for safety issues for their own employees, the contractors' employees, and the public. Some of these issues involved separate relocation times due to the nature of

their utility, and bulk of the work to be done in non-peak times. Some also mentioned sensitive safety issues unique to their specialized field that is regulated and required by the federal government.

- **Involvement in design phases**. One of the greatest needs expressed was for early involvement and consideration of the utilities in the design phase of the project. I see this as a way to save the public money, keep them safer, and reduce inconvenience.
- **Minimize or eliminate plan changes**. Almost all of the respondents expressed negative sentiments concerning plan changes and the unrealized impact of those changes on their efforts. Although they realized that sometimes change was unavoidable, if their input had been sought, those changes may have had less impact on their workload.
- **Specialization of certain utilities**. Certain utilities, due to government regulations, certifications/testing requirements, and risk involved, preferred not to contract out their part of the relocation to an SCDOT subcontractor, which would be a utility-approved contractor.
- **Special considerations**. Sometimes due to inclement weather, services that need to stay active, and unusual circumstances, special consideration needs to be given to these utilities. The earlier the utilities are involved, the sooner these issues can be discovered and resolved.

Overall, the utility respondents expressed a cautious enthusiasm toward implementing S.U.E. The attitude at the follow-up meeting suggested a willingness, and even eagerness, to begin S.U.E. as long as there was proper communication, coordination and cooperation with all parties involved.

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Coordination, Cooperation and Communication Questionnaire

The following questions and scenarios are designed to promote thought and discussion and encourage positive problem solving. Please respond to the ones that apply to your company and their relationship with the DOT. Thank you for your participation in this important project.

1. Utility Type: Name & Company (Optional):

   C-Communications; E–Electric; G–Gas; M–Municipality; S–SCDOT; W–Water & Sewer

   C1. CATV Charter Communications, Jim McKee
   C2. Fiber Cable, MCI/WorldCom, Clint Hinish
   C3. CATV, Charter Communications

   E1. Electric Utility, Duke Energy Corporation (Distribution), Tom Ramsey
   E2. Electric Utility, Duke Energy Corporation (Transmission) Roger Hurst
   E3. Electric Utility, Laurens Electric Coop, Frank C. Gusky, PE
   E4. Electric Utility, Laurens Electric Coop, Steve Hartsell
   E5. Electric Utility, Duke Energy Corporation (Distribution), Stan Compton

   G1. Natural Gas, Piedmont Natural Gas, Patrick Brown
   G2. Natural Gas, Fort Hill Natural Gas, Eric Thomas
   G3. Natural Gas, Piedmont Natural Gas, Ron Mays

   M1. Electric, Natural Gas, Water and Sanitary Sewer, Greer Commission of Public Works, Dennis Arrington
   M2. Utility Coordination for Greenville County: Tim Sewell, Trans System Corporation

   S1. SCDOT, Resident Construction Engineer, Spartanburg, Dennis Garber
   S2. SCDOT, Resident Construction Engineer, Greenville, Stephanie Amell

   W1. Sewer, Western Carolina Regional Sewer Authority
   W2. Water/Sewer, J.T.H. Associates
   W3. Water, Inman-Campobello Water District, Steve Poteat
   W4. Water
   W5. Sewer, Gantt Fire, Sewer and Police District, Michael Stansell

2. In a project you were involved with that experienced significant delays due to utility relocation, what might have been done differently in the various stages of the project to avoid these delays?

   C1. Have the power companies notify other utilities of progress, i.e. poles set, etc.
   C2. N/A
   C3. Better marking and staking of new right-of-way. Consistent updates on construction dates. Dates change too much to keep up.

SCDOT

E1. Had utility coordinating meetings early on. Usually the contractor comes in and announces his schedule and everyone has to work around this. The utility schedule should be built into the job at the beginning. Contractor should know when he bids that gas company (for instance, is not going to shut off the in the coldest weather of the year).
E2. N/A
E3. Our chief difficulty (other than resource availability) is the ability to acquire new right of way, obtain permission to trim or remove trees, and deal with joint use entities (CATV and TELCO) that may be on our pole lines.
E4. To inform the utilities where the construction would begin and try to stay with it. Work with the utilities company's prior to construction to avoid relocation of Major lines.
E5. No response.

G1. Earlier knowledge of conflicts and plan changes that were not communicated to the utility.
G2. Advanced utility verification is "useless", unless SCDOT/consultants ensure that preliminary information is factored into the design process.
G3. Too many SCDOT projects being performed in one year for all utilities to adequately perform their work, or relocations. To answer this question would be determined where utilities are in the design stage, see what utilities have conflicts combined utilities with plan engineers. The right of way department needs to secure more right of way when looking at the impact utilities have on new road construction. This would depend on the area of road pertaining to traffic.

M1. We had a major right of way acquisition conflict w/GSP Airport in order to relocate some large trunk mains. These R/W issues need to be finalized prior to bid and construction.
M2. Order or have on-hand cable, laminated poles, etc. prior to relocations needing help to be done. Have designated right of way that all utilities occupy.

S1. More utility involvement from SCDOT up front. More consideration of utility cost/time in staging of project and design.
S2. BellSouth never begins engineering until project starts. Duke Power – who is the contact now as of November 15, 2002 (when they restructured).

W1. Keep utilities informed on the progress of work. Provide Western Carolina with sufficient advanced notice as to when the sewer manholes would require raising / lowering or relocating the utility.
W2. Better up-front coordination.
W3. In some cases, utilities have not been notified in time.
W4. Not having DOT changing plans after utilities have been relocated.
W5. Phased projects with scheduled dates and locations should not "jump around" due to weather, etc. unless there are designated work zones that will utilize with all utilities notified.

3. How can we work together to reduce traffic delays, minimize service disruptions and provide a safe environment for all?

C1. Train your contract workers in safety as we do and emphasize quality workmanship.
C2. N/A

C3. Stay ahead of the game, let us know far enough ahead of time to do something about it.

E1. Utility coordination meetings & set up realistic schedule. (See above)
E2. On behalf of utilities, be aware of any lane closures required and plan well in advance.
E3. Our chief difficulty (other than resource availability) is the ability to acquire new right of way, obtain permission to trim or remove trees, and deal with joint use entities (CATV and TELCO) that may be on our pole lines.
E4. Keep each other informed of all work and the location of this work week by week. Try to maintain a one-person contact through out the project.
E5. No response.

G1. Better communication of every aspect of the construction from planning to completion.
G2. It is unreasonable for a utility to be at a "beckoned call," when SCDOT/contractor determines and changes daily schedules.
G3. Unfortunately, there are going to be traffic problems, however, give the utilities ample of time before moving in prime contractor to start road construction.

M1. No response.
M2. Perform relocations during non-peak traffic, service needs, etc.

S1. Utilities must be willing to work off-peak hours, *nighttime if needed.
S2. Have weekly or monthly meetings depending on size of project. Keep utilities aware of staging on the project so they know order of what to do.

W1. NA
W2. Current scheduling and updating frequency.
W3. Allow special jobs to be done late at night.
W4. No response.
W5. Better allocation of road closure. Multiple utilities (if possible) relocating/repairing lines simultaneously to prevent redundant road closures.

4. What might the DOT be able to do to encourage and facilitate earlier utility engineering and relocation? What tools do you need from the DOT to get the job done in a timely and efficient way?

C1. You're trying to do too much in too little time...our contractors are time-budgeted to get the job done for us. We need next year's projects, from you, this year so that we might budget these jobs in with our projects.
C2. Utility Relocation, though the problem of the utility company is a major undertaken. Due to the congesting of utilities on the DOT ROW, and utility companies just instructed to move to facilitate the DOT project. The plans from the start need to consider a utility corridor and location in that corridor for each utility, to reduce the struggle among the companies for position. Next schedule each utility to start its construction in the corridor.
C3. Notification and consistent communication. Clear right-of-way.

E1. Get accurate prints six months before job is let. Have utility input during design stage.

SCDOT

E2. Make sure that the utilities receive all final plans at least a year before let date (or earlier) and do not assume that local utility folks are going to forward plans to all departments involved; i.e.: distribution folks in Greenville to transmission folks in Charlotte. Transmission likes to be out of the way by LET DATE.
E3. Timing and scheduling is key in any project. Small companies like ours do not have unlimited construction resources. During the last several years, LEC has been implementing aggressive system improvement projects of our own, so it is becoming increasingly difficult to address DOT projects that seem to change in scope and location across our system. Planning for DOT projects at least 6 months in advance would help us tremendously in construction and engineering resource allocation.
E4. Meet with utilities during planning stages.
E5. This is my first meeting.

G1. Early communication about the project.
G2. #2 must be ensured. Then, if utility adjustments are made as directed by SCDOT/consultant/contractor—and subsequent adjustments are required due to further changes, or SCDOT error, the utility should be reimbursed.
G3. Provide utility agreements for 50% of relocations regardless of right of way. Provide for PNG gas line elevations versus storm drain elevations with coordination of both departments--surveyor to shoot elevation at storm drains/boxes. This is the standard practice, however, it is being done after contract is let or in the process of being let.

M1. Utility entities need a set of construction plans not preliminary, which will not change in any significant way. The subsurface investigation to resolve conflicts prior to bid is a good idea if properly implemented. Then, an initial contract for clearing/grubbing and utility relocation executed and completed prior to a road construction contract. Also, the SCDOT needs to resolve the issue of R/W provision for utility relocation. On some recent projects, the utility was given no assistance by DOT to acquire new R/W for relocation.
M2. No response.

S1. Liquidated damages to utility companies who drag their feet to relocate.
S2. Start earlier get utilities started earlier when major problems are foreseen.

W1. Provide plans to utilities at least two weeks prior to on-site meetings.
W2. Detailed construction sequence.
W3. Give utilities detailed maps.
W4. Mark centerline and right-of-way.
W5. In some cases, especially SPDs with minimal staffs, there is no good way to encourage early engineering. SCDOT currently is performing all notifications in a timely manner.

5. What conflicts do you encounter that could cause delays? (i.e.) Hurricane knocks out power in neighboring state and the electric company pulls off the project and goes into emergency operation in that area.

C1. Gas main cannot be shut off in peek cold weather. Traffic light power lines placed over cable lines, not facilitating relocation
C2. SCDOT has to my knowledge never caused a delay of an emergency restoration of our fiber.

SCDOT

E1. Trees not cleared. Grading not done. No right-of-way stakes put in when engineer is trying to draw up relocation job. Stakes gone and delays in getting them put back in.

E2. High peak times (hot or cold) that make it impossible to get transmission lines de-energized in order to do the work. Storm trouble is always a possibility.

E3. First and foremost, we have an obligation to our own customers. This includes not only responding to new requests for service, performing maintenance, and service restoration in the event of storms, but it also includes our own four year work plan which is filed with the Federal Government. We are under the oversight of the RUS, which expects us to complete our projects on time as much as our rate-paying customers and other agencies such as the DOT. Most of our more significant delays seem to stem from right of way acquisition and tree clearing difficulties. Please be aware that a lot of property owners are not willing to deal with us after the DOT has come before us obtaining their right of way. This has been especially true on the Hwy 72 project near Clinton. Please be aware that the clearing sufficient for roads, sewers, and non-electric utilities is often not suitable for electric lines. LEC typically obtains 20' on either side of the power line centerline in order to safeguard our system reliability. CATV and TELCO companies not transferring their cables from our poles cause other delays. Electric utilities everywhere are losing ground to CATV and TELCOs because the FCC is giving these companies more rights to access pole lines owned by electric utilities. Apparently, communication companies now have the right to get on utility poles without obtaining their own rights of way and to remain on poles abandoned by the power companies. Also, seasonal emergencies (high summer or winter loads) and other emergencies that affect system will cause us to divert resources from all projects, including DOT work.

E4. Storms, summer and winter loads.

E5. No response.

G1. Gas main cannot be shut off in peek cold weather. Limited on the amount of workers to do routine work and project work.

G2. High-pressure gas mains are critical at all times and very expensive to adjust.

G3. Or has one-way feed with numerous customers, especially restaurants/hotels, etc.

M1. No response.

M2. No response.

S1. No response.

S2. No response.

W1. Western Carolina performs sewer manhole modifications in-house. Typically, Western Carolina has not experienced any delays with contractors when sewer lines require relocation.

W2. Wet weather.

W3. No response.

W4. No response.

W5. Manpower restrictions.

6. What process(es) could your agency implement to minimize or avoid utility relocation-related delays?

C1. We try to stay on top of all the SCDOT jobs, but we aren't always notified by Duke/Blue Ridge of pole placements until the last minute.

C2. We have a working system. If you have an idea or want us to change something, let us know.
C3. Consider doing job on as built basis. Contract entire job out – engineering and construction.

E1. Utility coordination meetings before job is let. Don't wait until contractor is chomping at the bit to go to work to start trying to work out a schedule of who relocates first and second, etc.
E2. If we are notified in plenty of time, there is no reason for this utility to delay relocations. The only things, other than weather delays, are right of way acquisitions and special structure orders. This can be avoided by being notified well in advance of the let date.
E3. For the next 3 to 4 years LEC will be implementing a significant number of system improvement projects or our own. Two months may not be sufficient time to engineer all DOT projects. Larger projects, or those with multiple phases will require more time. Six months lead-time is preferred.
E4. Maintain communications between the field engineer and construction Supervisor.
E5. Plenty of notice.

G1. No response.
G2. See letter attached.
G3. A better working relation with SCDOT within the planning stage. What SCDOT considers a delay to construction may not be a delay to the utility company. For instance, materials and contractor scheduling.

M1. No response.
M2. Better coordination of utility locations, both horizontal and vertical, during the design process.

S1. Require utility companies who reside in right-of-way to have quality documentation of utility location. Do not allow new utility lines if one exists – they must upgrade, no run on both sides of road.
S2. No response.

W1. All of Western Carolina sewer lines have been GPS and maps can be provided upon request.
W2. Require detailed construction sequence (CPM?).
W3. Set up early pre-construction meetings.
W4. No response.
W5. Attending as many District related SCDOT meetings as possible.

7. Would your company be able to submit agreements and/or relocation sketches two (2) months prior to the letting? How much lead time do you need to accomplish this?

C1. Yes, as long as we get them in time to submit.
C2. I have no answer to this question; it will be case by case unless you do #4's response.
C3. No answer.

E1. Yes, if get accurate prints six months ahead of let date and right-of-way stakes get put in.
E2. See no. 4

E3. As stated above, DOT's clearing and grubbing often is not sufficient to accommodate our overhead conductors. Our ability to relocate depends on the following critical paths: 1) notification from DOT, 2) LEC site visit, 3) r/w acquisition and tree clearing permission, 4) construction resource availability.
E4. No, we would need at least two to three months.
E5. Size of the project would determine this and right of way agreements.

G1. Unknown. Will need at least a year notice to budget for any such work.
G2. It seems that much of the relocations could be avoided with proper attention to design and preliminary utility information from the field.
G3. Yes, however, PNG would need to know exactly the impact of the relocation for cost purposes. 6-8 months.

M1. No response.
M2. No response.

S1. No response.
S2. No response.

W1. Yes as long as the utility relocation plans are clearly marked along with existing and proposed grades.
W2. At least 2 months.
W3. No answer.
W4. No response.
W5. This would relate directly with prior notification. Major projects would require at least 6 to 8 months lead-time.

8. If the contractor were to clear and grub, and pull off the project for 30-60 days, would you be able to complete your work in that time period?

C1. Not if we were to place U/G plant in the line of any incomplete grubbing. We can't justify the possible loss due to cuts. If the C & G were complete, yes.
C2. Yes, Yes, Yes.
C3. Yes.

E1. Yes, if cutting and filling are not a factor.
E2. Yes, if our work has already been scheduled during that very 30-60 day time slot.
E3. 1) We need a list of all DOT projects affecting our system for the next 3 to 4 years. 2) On or before September 1 of the prior year, we need a revised list of the next year's projects so we can assess the budget impact to LEC. 3) Quarterly project updates would be helpful during the project year, 4) Individual project pre-construction and regular meetings during project implementation.
E4. Most of the time we would be able to complete utility relocation.
E5. Would determine what the grade would be.

G1. It is possible depending on weather and ordering of materials needed for project.
G2. Good idea, except that numerous utilities performing work in the same area at the same time would be difficult to schedule and complete within 60 days.
G3. Depending on the severity of the relocation, the initial 30-60 days is okay, but not on all jobs where all utilities are relocating. We cannot all work at the same time in some cases.

SCDOT

M1. No response.
M2. No response.

S1. No response.
S2. No response.

W1. Depending on the size of the project. The I-385 widening project took significantly longer than 60 days.
W2. No response.
W3. Yes, in most cases, if the project is not too big.
W4. No.
W5. This would be project specific.

9. What can be done to improve and implement better communication, coordination and cooperation?

C1. Notification, lead-time to relocate and avoidance of threats that our plant will "be pushed over" if we aren't there right away. We've been given this ultimatum on several projects and this has a definite impact on our response time.
C2. Do it.
C3. One point of contact that responds to feedback.

E1. Regular utility coordinating meetings that everyone attends.
E2. Regular updates or series of by-weekly or monthly utility/DOT/contractor meetings.
E3. OSHA and RUS guidelines typically will prevent the roadway/bridge contractor from doing the utility relocation work for LEC.
E4. One-person contact through out the project.
E5. Plenty of notice.

G1. Project updates (planning) at monthly utilities meetings would be a start.
G2. Utilities are not always at fault. Fort Hill makes every effort to accommodate and cooperate. SCDOT contractors damage utilities and always have an excuse not to pay. If at fault, SCDOT should ensure the contractor pays claims promptly.
G3. The present, with Flour Daniel/CRM West, has been the most coordination I have experienced in the last 12 years. An outside contractor, SCDOT does not have enough help and knowledge in Greenville County for these types of road constructions.

M1. No response.
M2. Have monthly status meetings for all construction projects for designated areas of the state.

S1. No response.
S2. No response.

W1. The current contractors the DOT uses to provide the utility plans are not being delivered on a timely basis. In some instances, no plans have been provided.
W2. Cell phone numbers of all "players".
W3. Always put road numbers and names in the tentative lettings. Mail or e-mail our office of any pre-construction meetings concerning our area.
W4. If the Coordinator sees something that he has a question about, please inquire immediately. We would much rather do the work right the first time.

W5. Notification as early I the project as possible.

10. What issues or problems need addressing for the DOT to include in the roadway/bridge contract to have the roadway/bridge contractor to do the utility relocation work for you? (This would include water and sewer lines, telecommunication conduit and pull boxes.)

C1. Where we know that prefabrication is taking place, we ask that a 4" pipe be installed in the structure for our use, as opposed to drilling and attaching after the fact. This speeds our process up. As far as someone else doing our relocation, we shy away from that scenario due to the possibility of any improper handling of the cable lines. Cable lines are bend sensitive and need to be handled carefully when moving.
C2. We are very much for this type of project, and it will remove 90% of the problems associated with utility relocation.
C3. Scheduling – who can be there and when/where.

E1. Use Duke approved contractors.
E2. N/A for Duke Transmission. For Duke Transmission to be informed properly, all highway drawings, copies of approved Utility Agreements and accompanying documents must be sent to:
Roger Hurst
Duke Electric Transmission
PO Box 1006 (Mail Code EC10Q)
Charlotte, NC 28201-1006
E4. We are an electrical company and I know you don't want to do this type of work!
E5. No response.

G1. Any pipeline work has to be done by a contractor qualified by and to work for the utility owner.
G2. Federal requirements prohibit such without proper qualifications and certifications and drug/alcohol testing of employees performing natural gas installations.
G3. N/A for PNG.

M1. No response.
M2. No response.

S1. No response.
S2. No response.

W1. Western Carolina prefers to contract directly with the utility contractor so that we can oversee the work and ensure the work is performed to our standards.
W2. Agree to do work for low bid received by Utility Coordinator.
W3. No response.
W4. No response.
W5. Approval by the Commission for the disbursement of District funds is required. Time is needed to research all issues of 'Prior Rights" before decisions on funding can be addressed. Large Scale projects that require extensive capital outlay must be evaluated for funding requirements.

heraldonline

Natural gas blast injures 3

By Tim Eberly The Herald

(Published November 27, 2002)

Three York County Natural Gas workers suffered serious burns Tuesday when a flatbed truck erupted in flames after one of the men apparently tried to drive it away from an exposed and leaking gas line, authorities said.

The victims, Tim Stegall, 42, Billy Mullis, 22, and Matt Evans, 24, all of Rock Hill, were flown to the Joseph Still Burn Center at Doctors Hospital in Augusta, Ga., where they were in stable but serious condition Tues-day evening, a hospital spokesman said.

All of the men suffered second-degree burns.

"They are coherent and talking, but in a great deal of pain," said Willie Stephenson, president of York County Natural Gas Authority.

Evans' father, Kenneth, said his son suffered second-degree burns on his face, arms and neck.

"He said he was OK, but the burns were hurting pretty bad," said Kenneth Evans, 51, of Richburg. "He didn't really know what happened because it all happened so fast."

Robin Conley, Mullis' future mother-in-law, said he suffered second-degree burns on his arms, face and hands. He also may have third-degree burns on his elbows.

Evans and Mullis will undergo surgery today.

Stegall's family could not provide details about his condition.

"He was just pretty much out of it," said his brother, Sam Stegall. "I really haven't had a good conversation with him. He's conscious, but that's about all."

The gas authority truck exploded into flames at 11:18 a.m. in front of Herlong Plaza in the 400 block of Herlong Avenue. As two media helicopters hovered overhead, the vehicle burned in the roadway until 1:45 p.m.

After area businesses were evacuated, authorities cut off the underground gas line at 12:37 p.m. and waited 45 minutes for the leaking pipe to "bleed out," Battalion Chief Mark Simmons said.

Stephenson is conducting an internal investigation into the incident -- the first-ever ignition accident in his 28 years with the gas authority. He said the flatbed truck should never have been parked so close to a live gas leak.

A crew of eight or nine workers was at the scene to fix a cracked feeder valve. They had accessed the pipeline 50 feet south of the accident site, and needed to dig another ditch 50 feet north of the leaking valve so they could simultaneously cut off the gas line from both sides before fixing the valve, Stephenson said.

They also had dug a ditch at the location of the cracked valve. While the rest of the crew worked at the other ditch, the three men apparently decided to move the truck away from the leaking valve, Stephenson said.

The fire may have sparked when Mullis, a recent hire who is in a probationary employment period, attempted to start the truck's engine, Stephenson said. On his first attempt, the truck apparently shut off, "but he must have tried to restart it," Stephenson said.

Stephenson said he was told Stegall, one of the crew's three supervisors, jumped on the vehicle's running board to stop Mullis. Stegall has been with the company for more than 20 years.

Evans, who was nearby when the truck caught fire, has been employed with York County Natural Gas since Nov. 4.

Witnesses horrified

Witnesses described a horrific scene as the three men, covered in flames, fled for safety. Four-year-old Amber Burgess felt the heat of the blast, which she said "sounded like thunder," from the Sunshine House day-care center at 481 S. Herlong Ave.

Through a store window in the shopping center, Brenda Brandon saw one man, later identified as Mullis, get out of the truck, rip off his shirt and roll around on the ground.

Either Stegall or Evans ran over to Phil Holmes, whose family owns PW's Gourmet Ice Cream, for help in removing his flaming shirt and orange work vest.

Holmes saw the third man rolling around on the grass to snuff the flames on his body.

Fearful a fire would run through the gas pipelines into nearby businesses, Holmes' wife, Ann, ran to Herlong Plaza and told store owners to open their doors and windows.

A quarter-mile line of traffic had accumulated behind the truck before it exploded, said Phil Holmes, who redirected the motorists.

"Some of them were stunned. Some were just rubber-necking," he said.

Contact Tim Eberly at 329-4063 or teberly@heraldonline.com. Staff writer Wendy Bigham and photographer Amber McCloskey contributed to the story.

http://www.heraldonline.com/local/story/1975970p-1926208c.html

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Washington DC: Crew repairing water line dcamaged the main. 11/6/01 (copyright washington Post)

Click for large picture **Size** **Description**

54k

Burning Road Grader (1989)
This tragic accident killed a 41-year-old road grader operator who struck a 10-inch propane pipeline while doing ditch maintenance in 1989 near the town of Lebanon in the Missouri Ozarks.

62k

Water Main Rupture (Washington DC, 2001)
Crew repairing water line damaged the main. 11/6/01 (copyright Washington Post).

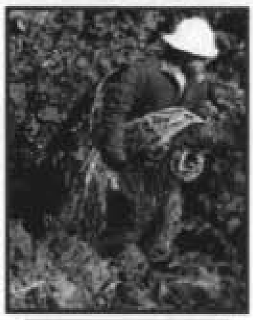
Burning Bulldozer (???)
This is an older photo that has seen wide use in underground damage prevention efforts around the nation. Details about the incident and the origin of the photo have been lost.

46k

56k

Saint Paul Fire (1993)

On July 22, 1993 in Saint Paul, MN, a backhoe struck a gas line as a city crew was repairing a sewer. Despite efforts to evacuate nearby buildings, 3 people died and 11 were injured in the ensuing explosion. *Hand digging is required by many state laws to safely expose underground lines for excavation equipment operators.*



119k

Telephone Cable Cut (1992)

Workers on a highway construction project severed a 900-pair and a 100-pair telephone cable cutting off service to 600 local homes and businesses in Abilene TX and isolating several small towns from the long distance network

30k

Water Main Rupture (1992)

Power company crews replacing a pole augered through a water main in Jenison MI. This dramatic scene shows the geyser that resulted when the main, carrying water at 70 psi of pressuer was punctured.

77k

Gas Main Rupture (1996)

With fire fighters providing a watery shield, a backhoe operator prepares to move his machine so the gas main he damaged can be repaired.

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Click for large picture Size **Description**

70 k

Destroyed Dozer

Ft. Meade MD--A contractor working for the military sliced through a 6-inch steel gas line with a dozer-mounted rock wheel, resulting in an explosion and fire that destroyed the dozer. The operator was able to escape unharmed by jumping from the machine as the flames erupted. Reports from the scene indicate the contractor was digging without a One-Call ticket, which is all too common for work on military bases. The line was owned by the local gas company. Reports indicate it burned for several hours with flames reaching 100 feet high. Several nearby power poles were destroyed. 7/6/99

31 k

Gusher With Backhoe

POWAY CA--A backhoe was engulfed by a million gallons of water after hitting a 24-inch water main. The backhoe was being used to prepare ground for a new housing division. The escaping water sprayed onto a road, causing the road to be closed for 11 hours. City workers were able to make temporary repairs on the main and the road surface to allow the road to be reopened. A city official said that if investigations showed that the subdivision developer was at fault, that company would have to compensate the city for all repair expenses.11/17/99

118 k

Gravel Pit Death Scene (1990)

The operator of this bulldozer died of burns a few hours after he hit a 12-inch natural gas pipeline near Simms MT. He was working in a gravel pit as part of a highway construction project. The line had been marked, but apparently the marks were obliterated at the point where it was struck.

Soggy Job (1994)

73 k

A Mobile (AL) news photographer took this photo of a city water department worker trying to stem the flow from a watermain damaged by a backhoe. It's not clear exactly why he was using what appears to be a pry bar.

107 k

Hasty Retreat (1995)

This is probably the only photo ever taken of a hit on an underground line at the moment the accident happened. The Saginaw MI news photographer was documenting the installation of a new city water main when an adjacent water line was struck.

47 k

Gusher (1996)

A 36-inch high pressure water main damaged by excavation equipment created this 100-foot gusher. The equipment was being used to construct a parking garage for a VA hospital in Los Angeles. No one was injured, but this scene dramatically illustrates the power that can be unleashed when excavators damage water mains.

75 k

Bogged Backhoe (1989)

This bogged backhoe became stuck on a pipeline right of way when it tried to rescue another stuck vehicle near Hopkinton MA. The 9-ton backhoe sank five feet into the mud and right on top of a pipeline. A larger tracked backhoe was brought in and positioned on a platform of timbers while it retrieved the mired equipment. The pipeline was not damaged.

87 k

Wall of Fire (1988)

One of the all-time classic pipeline accident photos, this scene is a result of a propane gas explosion that injured three workers. They were installing a new pipeline parallel to the propane line near Kemah TX. Apparently the weight of the tracked backhoe shown here caused a leak in the propane line and welding equipment ingited the leaking gas.

The Greenville N

TUESDAY, MARCH 7, 2000 ■ FINAL EDITION

Super Tuesday likely wi

16 states go to polls today as Bradley, McCain hope for a fighting chance

By Chuck Raasch
GANNETT NEWS SERVICE

It's now or never for John McCain and Bill Bradley.

The two men who spent January and February fighting for their respective parties' reform mantle have intertwining fates today in presidential primaries and caucuses across 16 states and American Samoa.

Both could be knocked out on the day dubbed Super Tuesday — if not numerically, at least symbolically, according to the latest polls.

Vice President Al Gore among Democrats, and, to a lesser degree, Texas Gov. George W. Bush among Republicans, have established strong electoral beachheads in most Super Tuesday states.

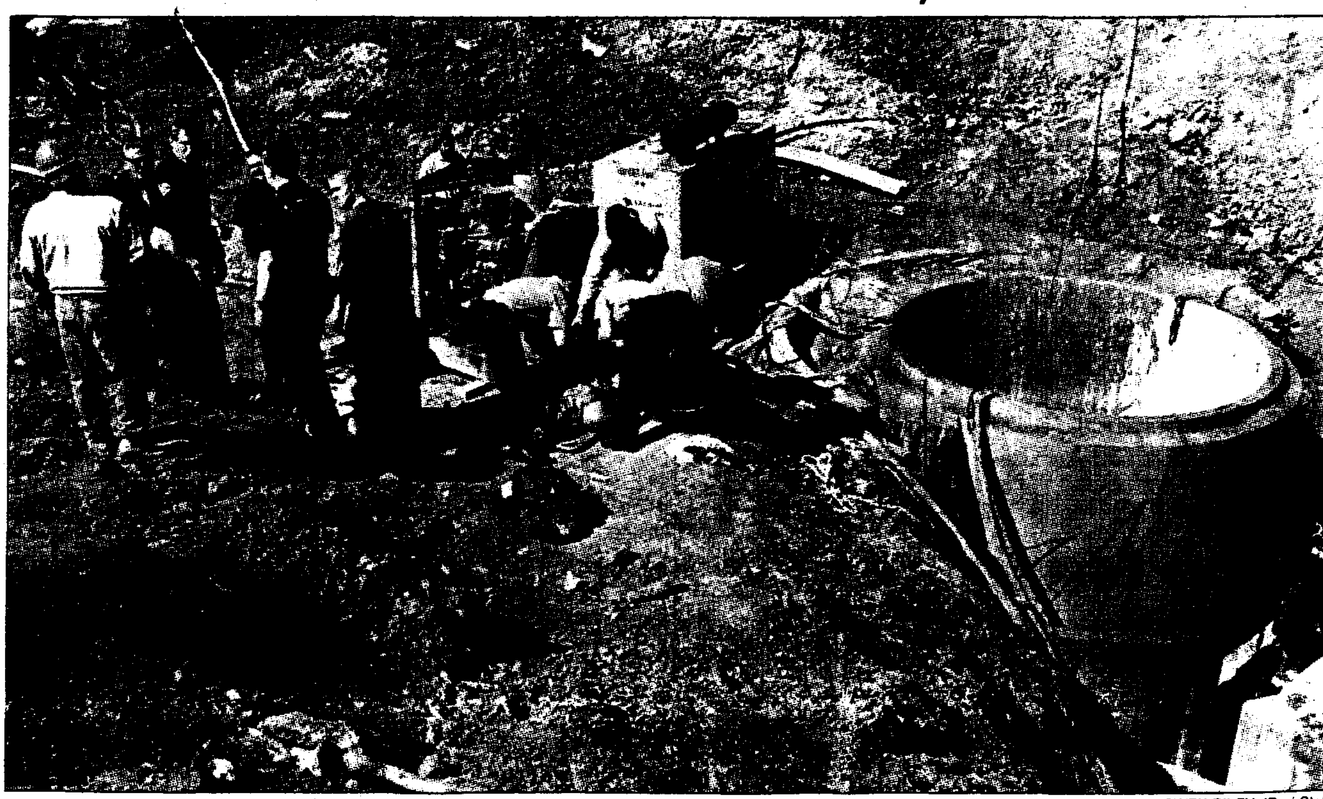
Gore leads everywhere over former New Jersey Sen. Bradley. Bush has a corner on delegate-rich California, and leads McCain, the upstart challenger from Arizona, in all contests outside the Northeast.

At stake for each party is about 60 percent of the delegates needed to win the nomination.

Bush re-established himself as the front-runner among Republicans with wins in Virginia, North Dakota and Washington state last week. But McCain could live to fight on after today if he wins states where polls say he has a chance.

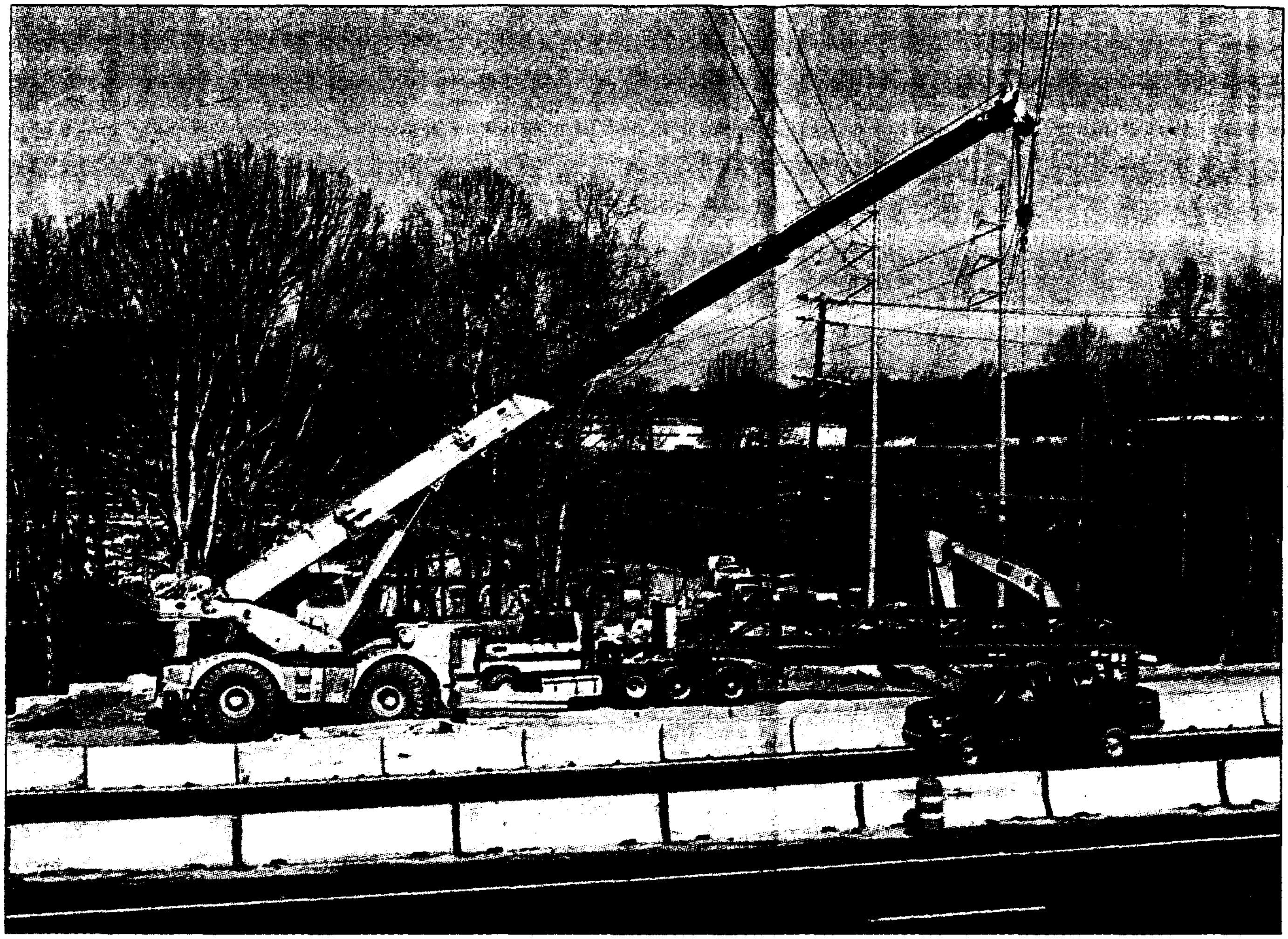
Bush leads in California, Georgia, Missouri and Ohio. New York is a toss-up, and

Construction workers take 7,000 volts



OWEN RILEY JR. / Staff

Electricity set victim's clothes afire: Paramedics treat a worker at a sewer-line construction site on South Pleasantburg Drive on Monday. Two workers were critically injured when they came in contact with a 7,000-volt power cable. Page 1B



BART BOATWRIGHT / Staff

Worker injured: A construction worker was shocked Wednesday when this crane hit a power line near West Phillips Road and Interstate 85.

Worker hit by electrical jolt

Crane maneuvered too close to high-voltage power line

By April E. Moorefield
STAFF WRITER

For the second time in three days, a Greenville County construction worker was seriously injured by a massive jolt of electricity Wednesday when a crane maneuvered too close to a high-voltage power line.

The latest of the two accidents happened just before 11 a.m. off West Phillips Road near where a new bridge is being built along Interstate 85.

Employees of Lee Construction Co. were using a crane to unload flatbed haulers when the machinery's cables touched a power line, said Capt. Tommy Blackwell of the Pelham-Batesville Fire Department.

An estimated 100,000 volts of electricity hit 29-year-old John Shackelford of Rock Hill when he grabbed the cables to try to stabilize the load, authorities said. Company officials couldn't be reached late Wednesday.

Shackelford was in serious condition Wednesday night in the burn center at Doctors Hospital in Augusta, Ga. He was first treated in the trauma center at Greenville Memorial Hospital after the electrical current struck his hand, swept through his body and exited his foot, according to officials with Greenville County EMS.

More than 7,000 volts of electricity injured two other construction workers earlier this week when a crane operating at a sewer line construction site along the Reedy River came too close to another power line.

Emanuel Martinez, 23, of Greenville, remained in critical condition late Wednesday at Doctors Hospital. The other worker, Don Weygant, 35, of Mauldin, who officials said was hit by the electricity when he rushed to help Martinez, was in serious condition at the burn center.

Martinez and Weygant were part of a Thalle Construction Co. crew Monday morning that was using a crane to move a large water pump from a ditch to the top of an embankment.

The crane operator told city detectives that he realized the cable hooked to the water pump was coming dangerously close to an electrical line and yelled to workers on the ground to stand clear.

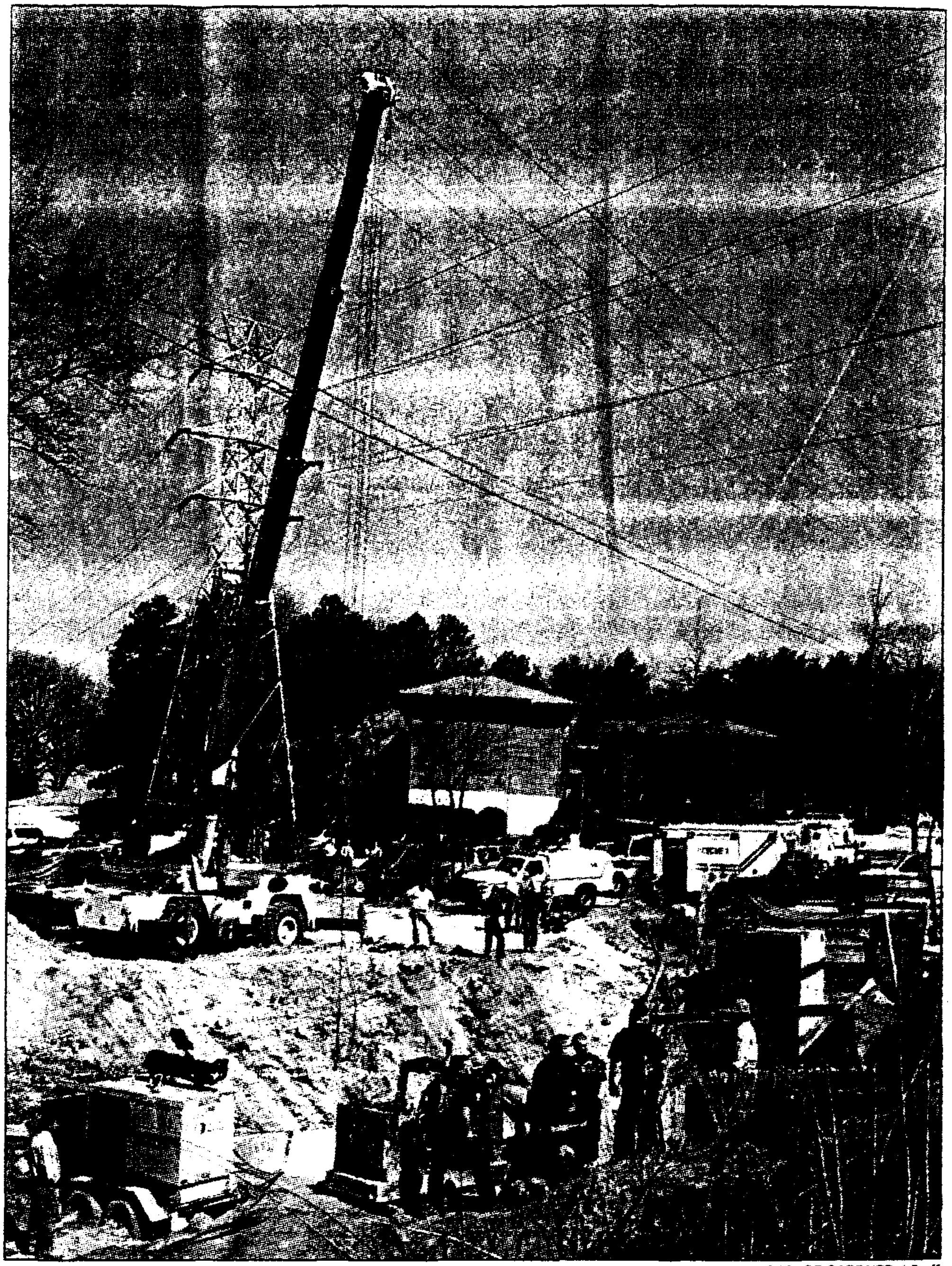
Martinez grabbed the cable to try and pull the pump onto the embankment, Greenville Police Detective Buddy Burgess said. Once he had the cable in his hands, police say they think the cable moved to within a few feet of a power line and the electricity arced, running through him.

Martinez received third-degree burns over 45 percent of his body, a spokesman for the burn center said Wednesday.

■ April E. Moorefield covers crime, breaking news and public safety in Greenville County. She can be reached at 298-4801.

2 men hurt in electrical accident

Both are in critical condition; they've been sent to Ga. burn center



GEORGE GARDNER / Staff

Accident scene: A crane looms near power lines at the site of an electrical accident that injured two workers Monday.

By April E. Moorefield and Jason Zacher
STAFF WRITERS

More than 7,000 volts of electricity jumped through the air to a cable in search of the path of least resistance to the ground. The path it chose went through Emanuel Martinez's body.

The jolt was so strong that it set his clothes on fire, according to police.

The Monday accident at a sewer line project along the Reedy River for Western Carolina Regional Sewer Authority sent Martinez and another worker, Don Weygant, to the hospital.

Martinez, 23, of 400 Summit Drive in Greenville, was transported to Greenville Memorial Hospital then sent to the Doctors Hospital burn center in Augusta, Ga., where he was listed in critical condition.

Weygant, 35, of Mauldin, also was seriously injured, authorities said. He, too, was treated in the trauma center at Greenville Memorial and moved to the burn center where he was listed in critical but stable condition.

Emergency workers said it appeared Weygant's arm may have touched the cable when he rushed to help Martinez.

Both are employees of Thalle Construction Company. Tom Eagens, project superintendent for firm, said work at the site near Pleasantburg Drive was shut down Monday and should reopen today. He was deeply saddened Monday evening.

"I've been in this business for 30 years, and I've never had anything like this happen," he said. "You never want to see someone not go home from work."

The workers were using a crane about 11 a.m. to move a large water pump from a ditch to the top of an embankment about 25 feet up, Greenville Police Detective Buddy Burgess said.

The crane operator told detectives that he realized the cable hooked to the water pump was coming dangerously close to an electrical line and yelled to workers on the ground to stand clear. Martinez grabbed the cable to try to pull the pump onto the embankment, Burgess said.

Once he had the cable in his hands, police say they think the cable moved to within a few feet of a power line and the electricity arced, running through him.

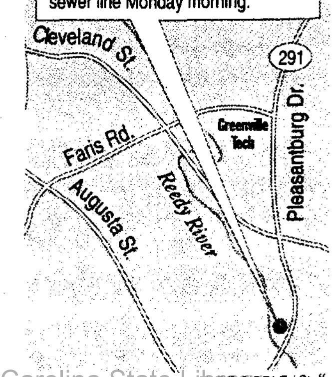
Joe Maher, a spokesman for Duke Power, said air normally acts as an insulator.

However, when two conductors — in this case the power line and the crane cable — come too close to each other, the insulating properties of air break down allowing the electricity to jump through the air.

The accident occurred in a matter of seconds, and few of the dozen construction workers said they knew exactly what happened.

Workers shocked

Two men were critically injured as they raised a water pump out of a sewer line Monday morning.



SUZIE RIDDLE / Staff

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Case Studies

- On a major highway project in Richmond, the **Virginia DOT's** consultant dug 156 test holes at locations where it was thought highway utility conflicts were possible. Using the data obtained, VDOT's roadway and hydraulics designers determined that conflicts would occur at 75 of the sites. As a result, design changes were made and 61 of the potential conflicts were eliminated. By making these changes, $731,425 worth of utility adjustments were avoided; whereas, the cost of digging the test holes was only $93,553, resulting in a savings of $637,872.

- The **Virginia DOT** credits SUE with helping to reduce the time needed to design highways from 5 years to 4 years, a 20% reduction in time.

- On a utility project in **Columbus, Ohio,** the Columbus Southern Power Company designed and installed almost 2 km of underground 138 kV electric line through the downtown area at lower cost, reduced risk, and ahead of schedule by including SUE in its design. The increased quality of the utility information presented at the prebid meeting increased the bidder's confidence in the construction plans, resulting in a bid which was $400,000 less than anticipated. The cost of SUE was less than $100,000. Additionally, there were no change orders as a result of utilities not correctly depicted on the plans, no utility relocations, no utility damages on the project, and no contractor claims.

- On a highway project in Maryland involving realignment and widening from 2 to 6 lanes, the use of SUE enabled the **Maryland State Highway Administration (MSHA)** to redesign the hydraulics system to minimize conflicts with utilities. Instead of impacting about 5,000 feet of each utility (gas, water, and sanitary), conflicts were reduced to about 400 feet of each. The cost for SUE was $56,000. Cost savings to MSHA and the utilities amounted to $1,340,000.

- On another project in Maryland, involving widening an Interstate highway from 4 to 6 lanes with full shoulders, retaining walls, and barriers, the use of SUE enabled **MSHA** to redesign the barriers and change the grading and ditches to minimize conflicts with utilities (gas, water, and telephone). The cost for SUE was $5,000. Cost savings to MSHA and the utilities amounted to $300,000, and the relocation time was reduced by 4-6 months.

- SUE was used on a highway project in **North Carolina** to locate a PVC water line along 18 miles of NC 168 in Currituck County. Location of the line was critical to determine conflicts with proposed pavement widening and shoulder excavation work. Using vacuum excavation, 40 holes were dug at a cost of less than $10,000. Using the resulting Quality Level "A" information, it was determined that approximately 21,280 feet of the water line could remain in place. This saved **NCDOT** an estimated $500,000.

- On another project in **North Carolina**, SUE was used early in the development of a project on the Southwest Loop Extension in Lenoir to identify utilities that needed to be relocated. Its use resulted in 16 storm drain boxes being changed to eliminate utility conflicts and in the assurance that 9 other storm drain boxes would not conflict with existing utilities. It was also used to accurately locate underground storage tanks.

- **Florida DOT** analyzed the use of SUE on major projects in Tallahassee and Miami and found that it saved $3 in contractor construction delay claims for every $1 spent for subsurface utility engineering.

- **Fairfax County in Virginia** started using SUE in 1980 in an effort to reduce construction expenses caused by unexpected utility hits, redesign costs, and contractor claims. Utilizing SUE during the design of projects has dramatically reduced the extent of the problems.

This page last modified on December 6, 2002
